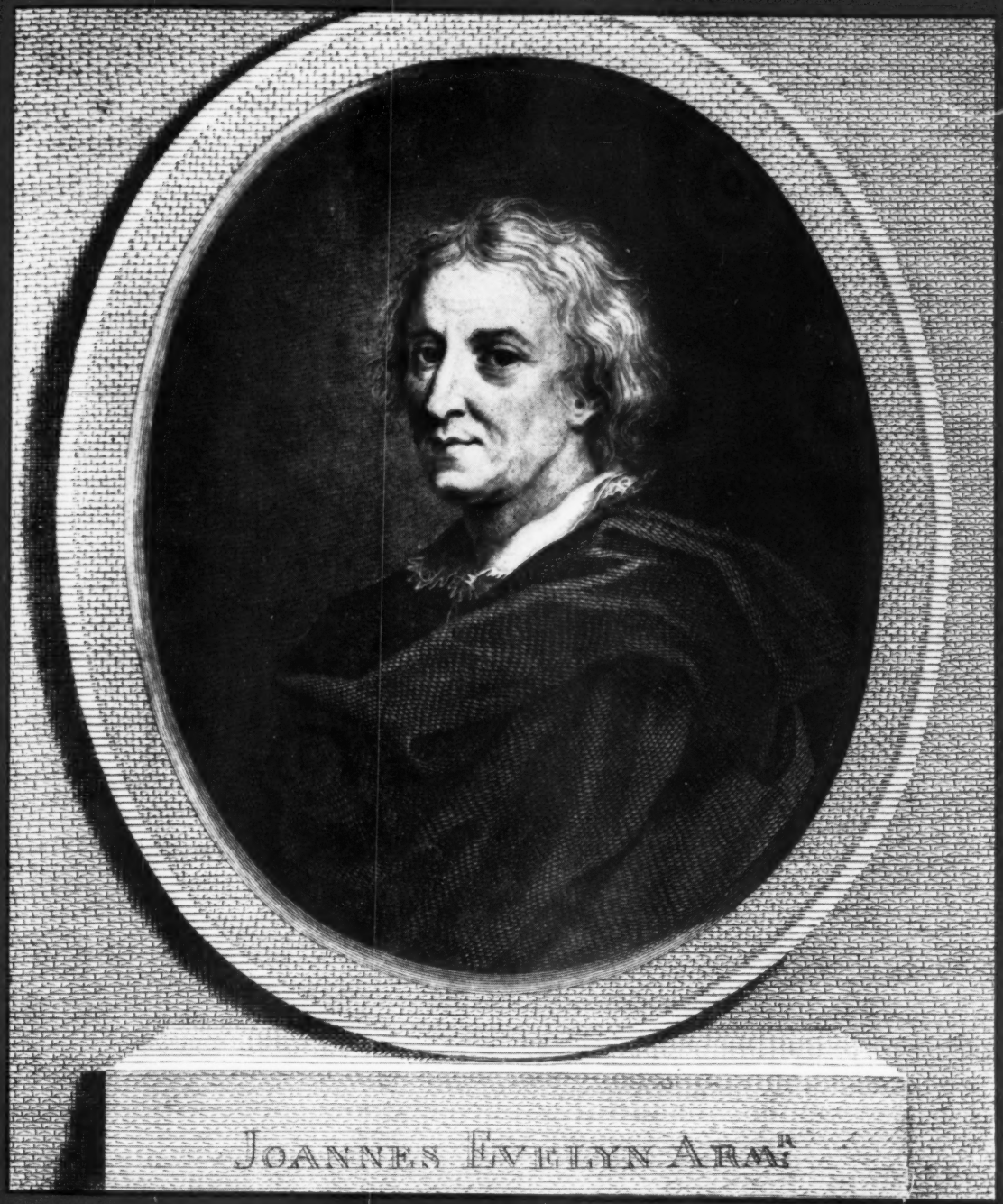
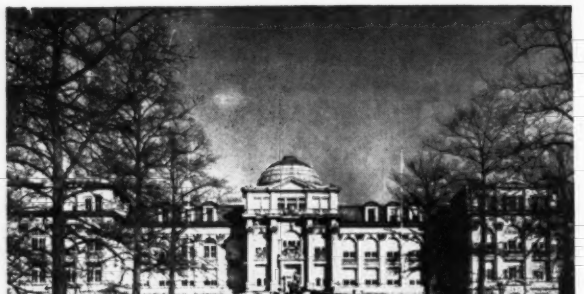


THE GARDEN JOURNAL

OF THE NEW YORK BOTANICAL GARDEN

Vol. 8, No. 2 March-April, 1958



Historic Home and Garden Tour, Princeton, N. J., May 1, 1958—Garden Club of New Jersey.

Third Eastern Orchid Congress, New York City, May 2-4, 1958; headquarters, American Museum of Natural History.

Spring Garden Tour of The New York Botanical Garden, May 8, 1958, Glen Cove, Long Island.

City Gardens Club, annual showing of gardens and penthouses, New York City, May 6 and 13, 1958.

Annual Meeting of The New York Botanical Garden, May 22, 1958.

Annual Meeting and Show of the American Rhododendron Society, May 28, 1958, in the Snuff Mill of The New York Botanical Garden.

Rose Day at The New York Botanical Garden, June 12.

THE GARDEN JOURNAL

of The New York Botanical Garden

DOROTHY EBEL HANSELL
Editor

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AMONG OUR CONTRIBUTORS

WILLIAM W. WILSON, M.D., really "rides his hobby." He initiated and presided at the First Eastern Orchid Congress held at "Longwood Gardens," actively participated in the Second Congress in Washington, D.C., last March, and is on the committee for the Third Congress which will be held in New York City this May, attended the Second International Orchid Congress in Hawaii last summer, and grows fine orchids which win prizes at the Philadelphia and other flower shows . . . DR. J. F. SCHAIRER is past president of the Second Eastern Orchid Congress, past president of the National Capital Orchid Society, and Editor of the Bulletin of the National Capital Orchid Society . . . DR. P. P. PIRONE, Plant Pathologist of The New York Botanical Garden, has agreed to rewrite completely for Oxford University Press, his Maintenance of Shade and Ornamental Trees originally published in 1941. This 422-page book has gone through two editions and three printings of the second edition. It has been used in many colleges, by commercial arborists and municipal foresters as well as by home owners interested in tree care. The new book will be ready early in 1959 . . . Under the direction of T. H. EVERETT, Curator of Education and Horticulturist, the Educational Program of the Garden has been expanded. New courses, for example, in house plants, roses, lawns, plant breeding, plants for home landscaping, have been added—and attendance has increased appreciably . . . DR. H. W. RICKETT is Bibliographer of The New York Botanical Garden, author of Green Earth and Botany for Gardeners . . . SPENCER HARRISON CAPREAL has carefully studied the cultural requirements for quality chrysanthemums and he "practices what he preaches" in his garden at Valhalla, New York . . . DR. EDMUND H. FULLING, who has edited and published the Botanical Review for twenty-four years, did his graduate research work in Dr. Stout's laboratory at the Garden from 1931-34. Dr. Fulling also edited and published Economic Botany which became a publication of The New York Botanical Garden last year . . . WALTER SINGER, a gardener in the Conservatory of The New York Botanical Garden, has a flair for photography. His pictures have illustrated magazine and newspaper articles and books, such as Exotica, and have taken prizes in exhibits . . . LEWIS LIPP is Horticulturist of Holden Arboretum in Kirtland Hills near Cleveland, Ohio . . . MRS. LILLIAN WEBER, an instructor in the Educational Department, is closely identified with the children's gardening program at The New York Botanical Garden . . . JOHN G. BORIN has been employed in the Gardening Department a number of years; his specialty is orchids . . . LOUIS P. POLITI, Head Gardener, is the man responsible for the growing of the thousands of plants used for outdoor display in the gardens and borders, and for indoor display in the Conservatory and at the International Flower Show . . . GERTRUDE B. FOSTER is editor of Herb Grower Magazine. Her home and garden in Connecticut are the background for her page, "The Country Housewife's Garden" . . . CHARLES C. CLARE, JR., botanical artist at The New York Botanical Garden for a little over a year, is making a series of plant sketches for The Garden Journal. The first two, *Magnolia grandiflora* and *Symplocarpus foetidus*, or skunk cabbage, appear in this number. Mr. Clare, who is a graduate of Earlham College, Richmond, Indiana, took special courses in scientific illustration along with his biology major.

CREDIT FOR ILLUSTRATIONS

We are indebted to the Display Committee, Mrs. Charles Burlingham, Mrs. Richard S. Meredith, Mrs. Donald B. Straus, for the selection of the front cover illustration—photo by E. N. Mitchell of Joannes Evelyn: Silva or a Discourse of Forest Trees, 1662; p. 38, Dr. W. W. Wilson; pp. 40, 41, Dr. J. F. Schairer; pp. 43, 44, 45, E. N. Mitchell; pp. 46, 47, 48, T. H. Everett; p. 50, C. C. Clare, Jr.; pp. 53, 54, E. N. Mitchell; pp. 56, 57, 58, Walter Singer; pp. 60, 61, Lewis Lipp; pp. 62, 63, E. N. Mitchell; pp. 66, 67, T. H. Everett; p. 68, upper, P. Foster, lower, C. C. Clare, Jr.; pp. 73, 74, E. N. Mitchell.

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E. Pluribus Unum

By W. W. Wilson

FOR MANY YEARS I collected things from match books to fish, or vice versa. I grew things, took pictures, traveled, joined societies, corresponded, built things. I fooled around with gadgets and a host of other interests which now hinge on my orchid collection. It can be said, therefore, that out of many hobbies has come one that encompasses all that have gone before. The motto of our country seems to summarize this epitomy of my avocational interests. In the following paragraphs I shall attempt to illustrate the polymorphic nature of orchid growing.

Individuals for thousands of years have collected things. As children I'm sure we all collected something. It is difficult to remember what I started with, but I recall numerous collections that I made, some of which I still continue, such as stamps. That orchids are not foreign to stamps is obvious. There are issues of many countries, notably Costa Rica, Colombia, Ceylon, Manchukuo and others that picture orchids. That is really not the point. If one is interested in orchids from a collector's standpoint, he must collect for collecting's sake and acquire as many types or sub-types as possible! This can take the form of actually going to an area where orchids grow in their native state, seeking them out and, of course, bringing them back alive. Or, he can sit in his study writing letters to various parts of the world and arranging for others to do the actual collecting in the wild, while he enjoys the comforts of home and waits for the mail, or the express, to bring them to him.

In just reading the above paragraph it is evident that many new facets are revealed. I mentioned going to various parts of the world and collecting. To do so travel is necessary. Travel in itself can be a hobby, but here there is another purpose than just traveling. If one likes to walk in the woods and enjoy nature, he can do so and still collect orchids. Again there is a purpose other than just walking and communing with nature. Correspondence with others; if one has a flare for letter-writing and likes to seek friendships with others in the world, usually at great distance, he can write. In writing it is no trouble to ask, "What are the local orchids? Can they be gathered and sent back?" A bonus is that with the letters returning there are stamps, and a collection of stamps increases as well. I have made interesting contacts with people all over the world just in writing to them seeking orchids growing in their locale. I doubt if I am the only one who has profited by this exchange of letters. I trust that others have been enriched as well.

To grow orchids I guess one must be interested in growing living things; and in seeing things grown under one's care great satisfaction is derived. Of course, other things besides orchids can be grown, but here we are discussing the highest developed form of plant life which includes some thirty thousand different species and now almost an equivalent number of hybrids. Certainly, in such a huge number there will be a type in which anybody can find satisfaction.

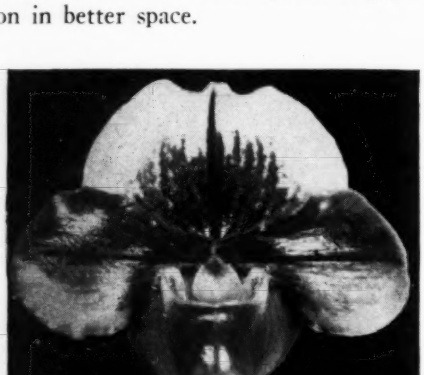
In beginning to grow orchids there is the urge to meet other people who also grow them. If you are a joiner or even if you are not, there immediately arises the opportunity to join local and national orchid societies, and even international societies, for the purposes of sharing experiences and even for social enrichment. I am sure there are people who grow orchids just for the sake of belonging to a society for the contacts that can be made. Orchid people in themselves are quite interesting, and I believe a study of them would be fascinating in itself, as the types of orchid growers are even more legion than are orchids.

In the growing process are many adjuncts of a mechanical nature that will help. In the first place, a greenhouse is usually needed which can be built if a yen for building is harbored by the individual; or if it is poring over catalogues that is enjoyed, there is a host of greenhouse construction firms that put out very interesting literature. The equipment that comes with these structures reminds one somewhat of a child's electric train paraphernalia, and almost anything can be done that is desired. Of course, if you are really ingenious you can design and make these things yourself. There is a gentleman in Cleveland, Ohio, who has a greenhouse full of gadgets that make his greenhouse do everything but speak, and I believe he is working on that. I doubt if anyone has ever heard about his orchids, but I may be unduly ignorant in this regard. We do not know all that can be done with a little electrical current, a few wires, a time clock, thermostats, humidistats, sunstats, and almost any other type of stat to which a prefix can be affixed. As far as money is concerned, a greenhouse can be erected and equipped for a very small amount, depending on the individual's mechanical ability, or for astronomical amounts based only on the robustness of the pocketbook responsible for the ceaseless assault. There is a greenhouse in New Jersey, not very large, and yet it contains over $100,000 worth of air conditioning and other equipment. The owner obviously was interested in mechanical things and not particularly in orchids themselves, and yet how better to express this interest of his than by growing orchids!

After the orchids are grown, what then? They can be left in the greenhouse to wither and die; they can be collected in the greenhouse into an artful arrangement. My wife derives great pleasure from using them as house plants when they are in flower. Indeed an orchid flower or plant may be found in any or every room in our house, and it is always astonishing for guests to enter the powder room and find themselves in the company of a little group of orchids as they "powder their noses."

Art for art's sake comes into the picture. Orchids are not as easy to paint as it would seem. As a matter of fact, I know very few artists who attempt to draw or paint orchids. Some are quite adept, but they are indeed few and far between. I should like to hurl a challenge at all would-be Michael-Angelos to get into the business of painting orchids. There are too few who do. Photography of orchids can be either an art

or for record purposes. I have been interested in photography, myself, as a hobby for many years. This hobby has been submerged to the taking of pictures for record purposes. All of my orchids when with flower have their pictures taken, and become ensconced in a file for future reference. As a matter of fact, with some species, once their flowers are taken and recorded, they have a way of losing interest and are passed on to another orchid grower, or discarded to allow other species to grow on in better space.



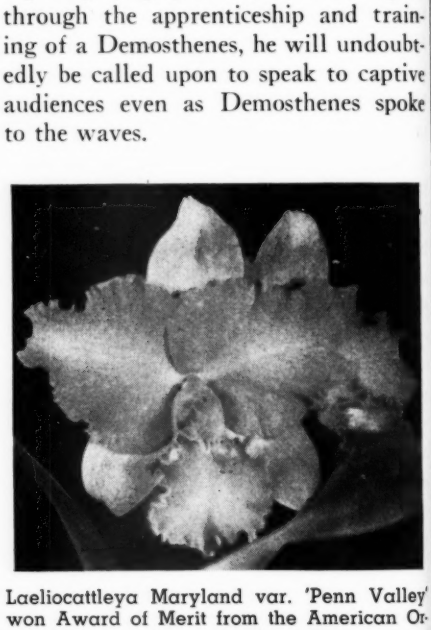
Cypripedium Winston Churchill var. 'Redoubtable' for which author received First Class Certificate from the American Orchid Society.

Further display endeavors than the house are available. There are shows that can be entered. A grower can show off his orchids with the pride of accomplishment in growing a beautiful specimen, for his skill in arranging them, or even for getting a free ticket to the show. Then, too, if he wishes to use just the cut orchids, there are many arrangement opportunities, not only in the home as table decorations for dinner parties, but again in competition in women's clubs, garden clubs, and in the large shows that take place in every major city in the United States.

As an evolution from exhibiting, there is judging. As one gains experience in growing orchids and in exhibiting orchids, he naturally acquires a more discerning eye and is soon asked to pass upon the efforts of others. A judge is born! That judging can become quite complicated would be well illustrated to anyone having the opportunity to listen in on a meeting of American Orchid Society judges. Not only does an orchid itself or a group of orchids have to be judged, but rules and regulations for judging locally, nationally and internationally have to be promulgated, and if one likes to write rules and regulations and has the abilities of a "sea lawyer," then he can sit down and not only grow orchids, exhibit orchids and judge orchids, but make rules and regulations for others to do the same.

I mentioned the word "evolution" in the last paragraph. One of the most interesting predictions in orchid literature seems to me to be the account Darwin wrote in his book, ORIGIN OF THE SPECIES. As I recall the facts, he discovered a new orchid in Madagascar, *Angraecum sesquipedale*. The flower has a pedicel about eighteen inches long. It was well known then, and, of course, it is well established now, that various insects are necessary for the fertilization of orchids. Darwin postulated then that there would be a moth with a proboscis eighteen inches long that would be capable of attaining the far reaches of that *Angraecum* pedicel, to remove the nectar, and, incidentally, to fertilize the species. Indeed, such a moth was discovered after Darwin's death. This is an interesting facet in the evolution of plants and insects, bringing us to the more scientific aspects of orchid growing. The anatomy and physiology of orchids may be studied just as with any other plant or animal. Experiments can be set up and carried out to determine the nutritional requirements of orchids. Orchid diseases may be studied and their cures worked out. (I defy, however, anybody to find a cure for the poor individual who collects orchids.) Classification and nomenclature are always a fascinating subject, and there is now the problem of hybrid registration to engage those interested in such phases of orchidology. I cannot begin to enumerate all of the scientific aspects of orchid culture. Present-day breeding methods of orchids have been made possible by studies carried out by famous students of plant germination, culminating in various formulae which have enabled orchids to be grown on a scale not dreamed of fifty years ago. It used to take at least ten years or more to bring an orchid from seed to flowering size. Now, the time has been shortened, in many instances, to only three to five years, and I remember seeing a photograph of an orchid in flower in a germinating flask. Such advancement of the first flowering of a seedling has come about by the work of many investigators in universities and in private laboratories throughout the world. This shortening of the length of time from seed to flower makes the study of inheritance factors in orchids more rapid; and from Mendel and his sweet peas of the nineteenth century we are now attempting to assemble facts that will stand the test of time in regard to the inheritance of various characteristics in orchids.

When considering the scientific aspects of orchids, judging of orchids, culture of orchids, and other phases, a writer can find vent for his literary talents, and although I do not mean to imply that this article shows new talent, there are others which merit attention; and authors, who can perhaps emulate Shakespeare, contribute regularly to scientific or semi-scientific journals, and even to the newspapers on the subject of orchids. Because there are orchid societies and societies have meetings requiring speakers, if one has gone through the apprenticeship and training of a Demosthenes, he will undoubtedly be called upon to speak to captive audiences even as Demosthenes spoke to the waves.



Laeliocattleya Maryland var. 'Penn Valley' won Award of Merit from the American Orchid Society—also grown by author.

If you are an embryonic orchid grower, however, and you do not wish to build things, collect things, tinker with gadgets; you do not wish to make arrangements, you are not interested in exhibiting in a show, you don't want to meet anybody, you don't wish to travel, you don't collect stamps, you can't write, you are mute, you are not interested in judging, you don't wish to breed your own orchids—then you can

(Continued on page 45)

GROWING ORCHIDS
In the Home and Garden

By J. F. Schairer

MEN AND WOMEN have found in growing plants a haven of peace and tranquility from the rush, bustle, and cares of this turbulent modern world of ours. Whether a plant is grown in the woods, garden, conservatory, patio, greenhouse, on a plant shelf, in a flower box, or in an old lard pail hung from the eaves of a thatched roof, it is a source of happiness to its owner if he but grows it well.

Ever since college days I have had an amateur's interest in botany and have been interested in the native orchids of the Northeastern States. In 1947 a local orchid society, the National Capital Orchid Society (affiliated with the American Orchid Society) was started in Washington, D.C. I joined as a charter member and almost immediately acquired an interest in tropical as well as native orchids.

My orchid growing in the home started when three small adventitious plants of *Epidendrum O'Brienianum*, that I had ordered, arrived from a plant dealer in Moorestown, New Jersey. I knew nothing of growing epiphytes but decided to learn. I potted one in good garden soil, one in a half and half mixture of garden soil and leafmold, and the third in pure leafmold and placed them in a west window in our attic. I had heard that orchid plants were easily burned with strong light. They got but very little light in that location. They lived in that location but did not thrive. The one in good garden soil did best. I soon rotted off most of the roots of the other two by overwatering.

Then I began to read about orchid growing, and when I gave these plants plenty of light and periodic feedings with diluted nutrient solution and placed them outdoors in the garden in summer they grew, thrived, and bloomed well. The bright red flowers are not large but are very gay and very effective in many-flowered terminal panicles which have a rachis which produces new flowers as fast as the old ones wither or are picked for a small corsage or boutonniere.* Success breeds confidence, and I soon added more plants of orchid species and hybrids. Today I have about eighty mature plants and have done well with most of them.

DESCRIPTION OF GROWING FACILITIES

Our house is a modest bungalow in a lovely wooded section of suburban Washington. We have a long narrow room 9′x15′ on the ground floor on the south side of the house. We call it the "play room." It is a nice light room with five 24″ x 36″ windows in the south wall and two similar windows in the west wall. This room has no basement below it. When our twins were small, we had insulation placed under the floor and covered the floor with bright blue linoleum. The room has plastered and painted walls and ceiling. Shelves were placed around most of the room for books and children's toys. In this room many family activities take place — there is a desk and telephone, a lounge chair and coffee table, a sewing machine, a typewriter table and, of course, my orchids.

In our semi-finished attic we have two 28″ x 38″ windows on the east side and a similar pair on the west side. Stepped plant shelves have been placed in front of the east windows and provide space for about twenty-five orchid plants which are placed here for a rest period. The light from the west windows is inadequate for orchids.

In addition to the seven window sills in the "play room" and the two east windows in the attic, we have a small backyard shaded by a maple and two apple trees and by high overhead shading from large maples, elms, oaks, and tulip poplar trees in our neighbors' yards. This damp yard with its varying degrees of shade is ideal for placing all the orchid plants outdoors on inverted pots on the ground during the warmer months of the year. The plants thrive during their sojourn outdoors.

MANAGING THE ORCHID PLANTS

STAGING. In the "play room" the plants are staged next to the windows on hardware cloth placed over copper trays containing wet sphagnum moss. The copper trays, which are twelve inches wide, rest on the top of the book-shelves or on a narrow wood-frame table whose height was planned so that the plants would receive the best light from the windows.

In the attic, resting plants are staged in pot saucers on a three-step wooden house-plant rack in the two east windows. Between each two plants is placed an empty pot saucer, which is kept filled with water, and large pans of water are placed on the floor below the plants.

HEAT. The "play room" is heated by a large hot-water radiator from the fuel oil furnace that heats the rest of the house. By adjusting the thermostat in the dining room the night temperature can be controlled in the "play room," so that it remains at approximately 58° F. over and adjacent to the radiator and as low as 50° F. adjacent to the two west windows which are farthest from the radiator. The importance of exploring a room for variations in night temperature must be stressed. Only in this way can the various plants be placed in relation to their optimum night temperature as well as light requirements.

LIGHT. For growing orchid plants in the home, south exposure is ideal (shading by sheer curtains can be employed if light is too intense at some particular period), east is next best, and west is only fair. North windows are usually unsatisfactory because of inadequate light. At the latitude of Washington, D.C., there is a large variation in the amount of light between winter and summer. Our "play room" is a lovely bright room in winter when the sun is at a low angle and when there are no leaves on the many deciduous trees. In the summer it is relatively dark, when

* "*Epidendrum O'Brienanum*—House Plant in Winter and Garden Plant in Summer," J. F. Schairer, Bulletin Nat. Capital Orchid Soc. 5, 5-6 (1951); The Orchid Journal 1, 429 (1952).

Some of the orchid plants which the author is growing in three of the windows on the south side of his "play room."

the sun is more nearly overhead and the leaves of trees cut off much of the light.

There is difficulty with light when plants are grown in windows in a room without a glass roof. The plants receive nearly all their light from one direction. There is no overhead light or light from the rear. The plants develop unsymmetrically and do not have the even shape of greenhouse-grown plants. There is considerable variation in the light received by plants staged immediately adjacent to the window and those which are staged behind them. Difficulties are encountered with tall plants which receive inadequate light, when they grow towards the top or above the top of the window. Plants grown in a home rather than a greenhouse gather more dust on their leaves, which clogs the stomata and also cuts down slightly on the light received by the leaf. About once a week when the plants are being watered and examined individually, I wipe both sides of each leaf with a soft damp cloth to remove dust and to improve the appearance of the plants.

I find that in winter when the temperatures are below freezing outdoors and the radiator is hot most of the time, my "play room" consumes from twelve to as much as twenty quarts of water per day. Plants dry out rapidly, particularly plants in the smaller pot sizes. I find it necessary to water thoroughly the plants by immersing in a pail or deep pan of water about twice a week. This "dunking" in a large volume of water also dissolves salts which accumulate by evaporation in the pots or on the potting material.

Plants which are placed in the east windows of the attic during their rest period dry out severely because of low humidity in the attic. Each is thoroughly soaked for an hour in a pail of water once each week.

POTTING AND FEEDING. Almost all of our plants are potted in porous clay pots. About half of them are potted with osmunda fiber and the rest in fir bark. So far the plants have thrived in both potting media. I do not feed mature plants in osmunda. Seedlings in osmunda are watered with very dilute "Hyponex" solution (half recommended strength) once in two weeks. All plants in fir bark receive this treatment once in two weeks, except those which are in a rest period and not in active growth. Plants in fir bark require more frequent watering than comparable plants in osmunda. Plants potted in osmunda dry out more slowly and can be left unattended for a longer period (for example, during a vacation trip) than comparable ones in fir bark.

I have a few terrestrials which I grow in a porous mixture of one third good garden soil, one third sharp sand and one third leafmold. These are sobralias, lycastes and calanthes. They are fed with the same dilute "Hyponex" solution every two weeks when in active growth.

HUMIDITY AND VENTILATION. Inadequate humidity is the major cause of failure in growing orchid plants in the home. When the light is bright during daylight hours, most orchid plants prefer a relative humidity of seventy percent. In most homes on such a bright day, it is difficult to achieve this humidity unless the plants are enclosed in a Wardian case or some similar semi-greenhouse. Every effort should be made to provide at least the minimum humidity for growth or survival. Staging on wire over pans of wet moss keeps the plants in a humid atmosphere without constant water at the roots which rots them and kills the plants. If wet moss or pebbles not quite covered with water are placed in the pans, there is more moist surface per square foot than if only water were placed in the pans. Pans of water are placed on top of the radiator and below it on the floor. In convenient empty space between plants, pot saucers filled with water may be placed on the hardware cloth. If possible the plant foliage should be sprayed with a fine mist two or three times a day. The humidity in our "play room" seldom drops below thirty percent and is usually around forty-five or fifty percent. We use two Taylor humidiguides in different parts of the room to check relative humidity.

Ventilation is usually not a problem in the home. Enough fresh air leaks in around the windows in winter. On warm days in autumn or in early spring, before it is warm enough at night to put plants outdoors in the garden, windows may be wholly or partially opened during the warm daytime hours.

WATERING. This is the most difficult aspect of orchid culture for the beginner. Certain plants such as cattleyas must dry out thoroughly between heavy waterings. Other genera must receive water again before such severe drying out. Still others must be kept moist at all times, and many plants must be kept moist when in active growth but much drier when resting after their blooming period.

Orchid plants fastened on bark or placed in wooden rafts in osmunda dry out too severely when hung in my "play room" and soon become dessicated and die. Even when they are watered every day, I have been unable to succeed with them in this way. Certain orchid plants which have a pendant habit will not grow upright in pots. For these I attach a vertical wooden "cradle" upright

on the edge of the pot, line it with osmunda and attach the pendant plant to the osmunda.

OTHER ITEMS. When plants are crowded, they fail to grow and bloom well. Each plant needs its quota of sunshine and of carbon dioxide from air. Crowding cuts down light and ventilation between plants and encourages plant pests. Recently I critically analyzed my growing conditions and gave away twenty-five plants. The result has been an increase in plant vigor and better number and quality of blooms.

From time to time one is troubled with orchid pests. Snails which are a problem in many greenhouses are no problem in the home. Only when the plants are outdoors in summer are they sometimes troubled with garden snails or slugs. A tablespoonful of "Snarol," a metaldehyde and arsenic poisoned bran bait, placed on the ground under each inverted pot used for staging takes care of these. In the house occasionally plant scale is introduced on a new acquisition. I spray all the plants twice each year, with a two weeks interval between the two sprayings, with "Fenorco" containing DDT. Little or no trouble with mites is encountered, if they are drowned out periodically by completely immersing the plant in water.

PREFERENCES IN ORCHIDS

Many individual preferences influence the orchid grower in his or her selection of plants for growing. To me a well-grown orchid plant with its bloom intact is an object of great beauty, whether it be an exotic cattleya with flower of large size, perfect shape, and superb color or one of smaller size, dainty and exquisite, or a spray orchid whose small flowers but gracefully arching and branching inflorescences paint a picture like the lines in an etching, or a small species with perky flowers in pendant racemes, or a dainty miniature, or even a grotesque catasetum or masdevallia. When the flowers have a subtle perfume, such as the aroma of vanilla or cloves or of an unusual spice, the beauty is enhanced. Fragrance is part of the picture. I seldom cut a bloom from the plant. To me it is part of the plant and part of this beautiful picture until it fades, and the picture is gone till next blooming time.

My preferences may be summarized as follows:

(1) At least one orchid plant in good bloom at all times between October 15 and March 15 and occasional blooms or bursts of bloom during the rest of the year to keep up interest.

(2) Four or five plants in flower during the Christmas season, preferably with different colors and sizes of the flowers and shape of the inflorescence.

(3) A diversified collection consisting of plants of many orchid genera to provide a maximum challenge in growing and a pleasing variety in foliage, plant size and type of bloom.

(4) Several plants which I have never tried before for the pleasure of learning how to grow them.

Certain practical considerations must temper my preferences. The temperature, light and humidity conditions in my "play room" preclude the growing of some desirable plants. Some plants are too large or too tall or have ten-foot-long bloom spikes and thus are not suitable for window sill conditions. Some plants require particular care and feeding in summer, when I am usually away for several weeks at a time.

FUN WITH ORCHIDS

Here I shall list just a few things that may bring much pleasure to an amateur orchid grower:

(1) Obtain unestablished jungle plants from importers or collectors or friends abroad and learn how to establish them* and know the joy of seeing a plant grow and bloom again.

(2) Try plants of unusual genera not in most amateur collections to learn how to grow them and to find out whether they are worth growing.

(3) Try several plants of the same species from different native localities to note the variation in quality, color, and so forth, in an individual species.

(4) Share orchid beauty with others. You can preserve all but the fragrance by taking a good kodachrome picture of a fine plant in bloom at the peak of its loveliness. This will sharpen the focus of your memory, and you may enjoy the beauty of a plant for years and share it with many friends.

SUCCESS AND FAILURE UNDER MY CONDITIONS

First let me list some orchids that have not done well under my conditions:

(1) Dendrobiums of all types have done poorly. The violent fluctuations of humidity are more than they can take. With the evergreen types I have often had buds showing color dry up and fail to open.

(2) Phalaenopsis can not take the low humidity. Plants gradually wither and die after a few weeks, months or a year or two.

(3) Cymbidium plants are too large and the bloom spikes too tall. Furthermore, I am away during the early summer months when they need maximum care and feeding, and my winter temperatures are too high and humidity too

(Continued on Page 69)

* "Jungle Plants for the Ameteur Collector" by J. F. Schairer, Bulletin Nat. Capital Orchid Soc. 6, 43-45 (1952); The Orchid Journal 2, 168-169 (1953).

The southeast corner of the "play room."

GIBBERELLIN —

PLANT-GROWTH STIMULATOR

By P. P. Pirone

FEW OF US REALIZE how profoundly the fungi have influenced mankind. Not only have these non-chlorophyll-bearing plants changed the living habits of entire nations, but they also have changed the course of modern history.

The British, for example, are heavy consumers of tea because of a fungus parasite of coffee. Ceylon was a major producer of coffee, until a rust fungus invaded the coffee plantations and caused yields to drop so low that growers found it unprofitable to grow that crop. Tea was planted and proved highly productive. Coffee cultivation then shifted to South America and is now the major crop in that hemisphere.

Another fungus was responsible for a similar situation in South America, the first great natural rubber-producing area. The leaf-blighting fungus became so destructive to rubber-bearing hevea trees that their cultivation was no longer profitable. Rubber plantations were then established in the Far East, which is the present major producing area.

A little more than a century ago, the fungus *Phytophthora infestans* destroyed the potato crops in northern Europe, especially in Ireland, and thousands of people died of starvation or related causes as a result of the potato blight. Hundreds of thousands of Irish and other northern Europeans migrated to America to escape the ravages of the famine.

More recently several fungi have profoundly affected the lives of all humans. These are the fungi which produce germ-killing substances known as antibiotics. Best known and most widely used is *Penicillium notatum*, which produces penicillin. Other widely used and highly effective antibiotics secured from fungi are streptomycin and aureomycin. New ones are being discovered and introduced each year.

NEWEST FUNGUS PRODUCT

Another fungus which may eventually influence the living habits of mankind is *Gibberella fujikuroi*. This fungus produces some of the most unusual plant - growth - stimulating substances ever discovered. These are variously referred to as gibberellins or gibberellic acid.

Gibberellins were first identified in 1926 by a Japanese plant pathologist, E. Kurosawa, who extracted them from the synthetic food on which the gibberella had been growing. This fungus has long been known to cause a disease of the rice plant known as the "bakanae" disease. Rice plants attacked by this fungus grew taller than healthy plants. Mr. Kurosawa reasoned that something the fungus produced must be responsible for the peculiar growth stimulation to the rice plants.

Fifteen years later, a crystalline material, gibberellin A, was isolated and shown to possess the unusual growth-stimulating properties. Eventually three compounds exhibiting similar physiological activities were isolated: gibberellin A_1, gibberellin A_2 and gibberellic acid. The latter was obtained in pure form by research scientists in the United States and Great Britain. Recent research suggests that *Gibberella fujikuroi* is almost unique among the fungi in its ability to produce gibberellins. Tests at Purdue University revealed that of the more than one thousand fungi examined, none was capable of producing this growth-promoting substance.

The name gibberellin has been suggested as the generic term to be used for gibberellic acid, as well as gibberellins A_1 and A_2.

The first gibberellin to be made available commercially was the potassium salt of gibberellic acid. Unlike the acid, it is readily soluble in water. This compound was marketed early in 1957 under the name "Gibrel" by Merck, Sharp and Dohme. Since that time at least six other companies have placed gibberellins on the market.

Merck, Sharp and Dohme has established grants at many agricultural experiment stations around the United States to probe deeper into the gibberellin mystery. One such grant was established at The New York Botanical Garden, and some of the information presented in this article was obtained from the work conducted under this grant.

As with all new and unusual products, a great amount of publicity, some factual and some overly-enthusiastic, has appeared in the past year. This has, quite naturally, led to some confusion and some disappointments. This article has been prepared, therefore, to help dispel some of the confusion and to aid in a better understanding of just what the gibberellins are and what they will and will not do.

HOW GIBBERELLINS ARE MADE

The gibberellins are presently produced by growing the gibberella fungus in large vats on special food, much like the penicillium fungus is grown to produce penicillin. The active ingredient is extracted from the filtrate (and not the fungus itself) after a certain period of time.

Obviously this method of producing gibberellins is costly. When the gibberellic acid was first placed on the market early in 1957, it sold for about five thousand dollars a pound. Because of improved techniques and mass production, the price dropped to eighteen hundred dollars a pound by the fall of the same year! This is actually not too expensive, because the amount needed to produce a response in plants is extremely small. Its use is actually measured in parts per million (ppm) of water. Some crops will respond to as little as one tenth of an ounce per acre! The usual dosage in foliage spray varies from one to five hundred parts per million, and the most frequently recommended dosage for ornamental plants is ten parts in a million parts of water.

These amounts are so tiny that it would be extremely difficult for the home gardener to measure them properly. Consequently, the gibberellins are put up in powdered form mixed with inert diluents so that the user needs

only to mix them in the recommended amount of water to obtain the proper dilution.

Once dissolved in water, they must be used within a day or so, for gibberellins lose their effectiveness rapidly in water solution. Gibberellins are also available in liquid form, dissolved in alcohol, and are able to keep their potency indefinitely in this form. They must be diluted in water just before being applied to the foliage, however. Several brands of gibberellins are also available in so-called aerosol bombs. These merely require the pressing of a button to release the active ingredient, and no mixing is required.

Geranium 'C. E. Hill,' on the right received four applications of Gibrel, 10 ppm, at two-week intervals; the same variety on the left received four sprays of plain water. Both plants were exactly the same size at the start.

How Plants Respond

Stem elongation is the most striking response of plants to gibberellins. The distance between the nodes is strikingly greater on treated plants as compared with that on untreated ones. Some plants grow up to three times their normal height within a month.

As soon as gibberellin is applied, plants susceptible to its action begin to grow rapidly. With some plants, a single application will speed up growth for many weeks. With others, continued applications at frequent intervals are needed to produce continued plant response. When the applications are discontinued, growth soon slows down to a normal rate.

Each variety of plant responds differently to the gibberellins; hence no set rule-of-thumb can be given, except that most ornamental plants which do respond can be treated with amounts varying from ten to one hundred ppm. Some plants respond at almost any stage of growth, others only at certain stages, and still others do not respond at all. Only carefully conducted experimentation will reveal the specific requirements and responses of each plant. Gardeners who use gibberellins should remember that overdosing and overtreatment will cause excessive stem elongation. The manufacturer's directions should be followed to the letter.

How Gibberellins Act

The way in which gibberellins act to stimulate plant growth has not been clearly shown as yet. According to Dr. Paul Marth, of the United States Department of Agriculture, no other known plant growth-regulator produces the same effect as gibberellins. Studies by Dr. C. A. Berger of Fordham University have revealed that gibberellins do not react on cell divisions as do colchicine and growth-promoting substances such as alpha-naphthalene acetic acid.

Other Responses

The gibberellins are unusual in that they do more than just make some plants grow taller. They are also capable of breaking the so-called dormancy of certain plant parts. Potatoes can be made to sprout without going through their normally required resting period.

The so-called "after-ripening" period in apple and peach seeds can be bypassed by treating with this unusual substance. Even the dormancy of whole peach trees can be broken. Under natural conditions peach trees become dormant at the end of the growing season. Such dormancy is broken only by low temperatures. An 'Elberta' peach tree, for example, will start to grow again (assuming external growing conditions are favorable) when it has had nine hundred and fifty hours of temperature below 45° F. In young peach trees this dormancy has been broken with several sprayings of gibberellin, without the required low temperature period. Should mature peach trees respond in the same way, without undergoing any harm to their other physiological processes, it may be possible for growers in the Deep South to raise peach varieties which normally require a long chilling period.

Another unusual effect of this substance is to change the entire habit of certain plants. For example, 'Little Marvel' peas which are dwarf in habit can be made to grow taller than the standard varieties like 'Alderman' and 'Alaska.'

Somewhat similar effects on virus-stunted plants were recently reported by Dr. Karl Maramorosch of the Rockefeller Institute for Medical Research. Several species of plants stunted by virus disease were made to grow to normal size by gibberellin sprays. The virus, however, was still present even though the plants outgrew the stunt.

Two applications of Gibrel, 10 ppm, at two-week intervals made the plant of *Oxalis Bowieana* on the right flower profusely four weeks after the growth-stimulator was applied. The plant on the left was just beginning to form a few flowers at the time this photo was taken.

Many gibberellin-treated seeds have been found to germinate more rapidly than untreated ones, particularly if they are planted early in the growing season when the soil is still cold and wet. Pea and bean seeds emerge up to a third faster and hence are less subject to seed and seedling decay. Similarly, a five-minute dip of potato seed pieces in gibberellin made them sprout from one to two weeks earlier than normal. Lettuce seeds have been made to germinate without the special light treatment they normally need.

Most of the present evidence suggests that the gibberellins have little effect on root development.

Effect on Flowering

Flowering may be hastened or delayed, depending on the kind of plant treated. With some plants there is no effect in either direction.

In the case of the common geranium, *Pelargonium hortorum,* not only do the plants grow taller, and the leaves larger, but the flowers open sooner and last longer than normal.

At the Kingwood Garden Center in Ohio, the geranium 'John Forbes,' which normally makes very slow vegetative growth, was made to grow into a standard (one stem) plant.

When used on grown plants of stock, petunia, larkspur, English daisy, China aster, gerbera, and oxalis, gibberellin speeds flowering time anywhere from ten days to four weeks.

Effect on Seed Production

Gibberellins have a marked effect on seed production in some plants. Head lettuce, for example, can be made to produce viable seeds ten to thirty days earlier than normal. Biennials such as carrot and cabbage can be made to bypass their normal cold requirements for flowering. Normally it takes fifteen or more months, with a cold period in between, to produce carrot and cabbage seed. Using gibberellin, seeds have been produced within six months after planting.

Seeds produced by gibberellin-treated plants do not inherit their growth-promoting ability, and plants produced from these seeds exhibit normal growth.

Effect on Vegetables

Many vegetables also show a striking response to gibberellin. Celery grown in northern states responds favorably by making increased growth and maturing earlier than untreated plants. Celery grown in the southern states, however, grows too "leggy" and develops seed stalks prematurely.

Tomatoes will set fruit at temperatures lower than those ordinarily considered the minimum for fruit set. Seedless tomatoes may also develop on gibberellin-sprayed plants.

The growth of parsley, a slow-growing plant, is greatly speeded up by gibberellin sprays. Broccoli forms heads from seven to ten days earlier. Spinach, cucumbers, eggplant, and beans also show a favorable response.

Effect on Trees

United States Department of Agriculture researchers found that young forest trees such as tulip-poplar, willow-oak and maple grew much taller when treated with gibberellic acid. The same applications to two species of pine and a white spruce resulted in only a slight increase in length of terminal growth. In other words, trees behave like other plants—some respond, others do not.

Effect on Small Fruits

'Thompson Seedless' grapes sprayed with fifty ppm of gibberellic acid gave a significant increase in berry size and thus eliminated the need for the costly and yield-controlling girdling practice, a hand-labor job that involves cutting into the bark of the vines. There are so many 'Thompson Seedless' grapes grown in California, that nine million dollars worth of gibberellins would be needed to replace the hand-girdling practices now employed!

After two applications of Gibrel, 10 ppm, at two-week intervals, the carpet bugle, *Ajuga reptans*, on the right flowered weeks ahead of the same kind of plant on the left. Photo taken four weeks after start of tests on plants of the same size.

Effect on Grass

Little work has been done on the effect of gibberellins on turf grasses. A few recent observations are worth mentioning, however. When sprayed in October, bluegrass lawns made new growth within four days of treatment. This suggests that this type of grass can be made to grow later in the season and perhaps earlier in the spring with such sprays. In Michigan, brown, frozen grass sprayed with gibberellins turned green within five days, while untreated sections of the same turf remained brown.

Role of Plant Foods

A question frequently asked is whether gibberellins replace plant foods. The answer is no, because they are not plant foods but merely growth stimulators. They are not known to replace any of the materials used in plant growth.

As a matter of fact, in many situations, more plant food is needed where gibberellins are used in order to produce well-balanced growth. One of the disadvantages of the gibberellins, particularly where they are used too frequently or at excessively high concentrations, is that the plants not only grow too spindly (leggy) but the leaves are more chlorotic (yellow). The use of additional plant food, either mixed

Flowering tobacco, like the species grown for smoking, is responsive to gibberellins. The plant of *Nicotiana alata* on the right received three applications of Gibrel, 10 ppm, at two-week intervals; the plant on the left was sprayed with plain water.

fresh and applied as a foliage spray or applied via the roots, helps to make a more compact, healthier-looking plant.

The gibberellins in their presently available form cannot be packaged with plant foods. Their effectiveness soon disappears, because they are incompatible with the acidity and moisture content of the plant foods.

However, the gibberellins can be made up fresh and mixed with some of the well-known plant foods sold specifically for foliage application.

Use on Food Plants

The latest data presented by reliable research workers indicate that the gibberellins present no apparent hazard either to the individual who uses the material for agricultural purposes, or to the individual who consumes products which have been treated with them.

In late December 1957, the Food and Drug Administration, the Federal agency empowered to give clearance for the use of gibberellins on food crops, stated that it will offer no objection to the following proposals:

1. The use of 0.5 grams of "Gibrel" in treating one hundred pounds of various seeds to promote faster emergence. 2. The use of a 1 ppm solution of "Gibrel" for a seed-potato dip to break dormancy. 3. The use of a 5-50 ppm per acre spray of "Gibrel" in the early growing stages of 'Thompson Seedless' and 'Black Corinth' grapes to increase fruit size.

These appear to be the first clearances granted for using gibberellins on food crops. In all probability many more will be granted as additional tests are conducted.

Upper—The fragrant geranium *(Pelargonium graveolens)* on the right was sprayed with 10 ppm Gibrel two weeks earlier; the one on the left was sprayed only with water.

Lower — The Jerusalem cherry *(Solanum pseudo-capsicum)* on the right received four applications of Gibrel, 10 ppm, at two-week intervals; the plant on the left received plain water sprays.

Upper—The sedum on the right received two sprays of Gibrel, 10 ppm, at two-week intervals; the sedum on the left received two sprayings of plain water.

Center—The plant of *Plectranthus australis* on the right was sprayed with 10 ppm Gibrel two weeks earlier; the plant at the left was sprayed only with water.

Bottom—*Fuchsia hybrida* 'American Beauty' on the right received a single application of Gibrel, 10 ppm, four weeks earlier; the plant on the left, of equal size at the start, received a single spraying of plain water.

Use on Field Crops

Cotton with longer fibers (which commands a premium price) has been produced; longer-stemmed roses have been grown; sugar cane has been harvested earlier than normal; and tobacco plants have been made to produce more and larger leaves.

Cotton and certain pasture grasses like Bermuda grass, which do not grow well in cold weather, have been made to grow at lower temperatures with applications of gibberellins.

Certain varieties of sugar beets will not produce seed in this country. There is some evidence that the gibberellins may help to produce seed on certain bolt-resisting varieties. In this case the gibberellins appear to substitute for part of the light and temperature required to produce viable seed.

Lest the readers of this article get the impression that the gibberellins will solve all their growing problems, the writer hastens to repeat that many plants do not benefit from this substance. This is particularly true where compact growth is important.

One thing most gardeners try to achieve is a well-branched, compact plant. That is why plants like hardy chrysanthemums are pinched several times early in the growing season. Gibberellins produce just the opposite effect on some plants, and hence their use must be carefully regulated. When used exactly as recommended by the manufacturer, however, even the growth and flowering of chrysanthemums can be improved by using the gibberellins.

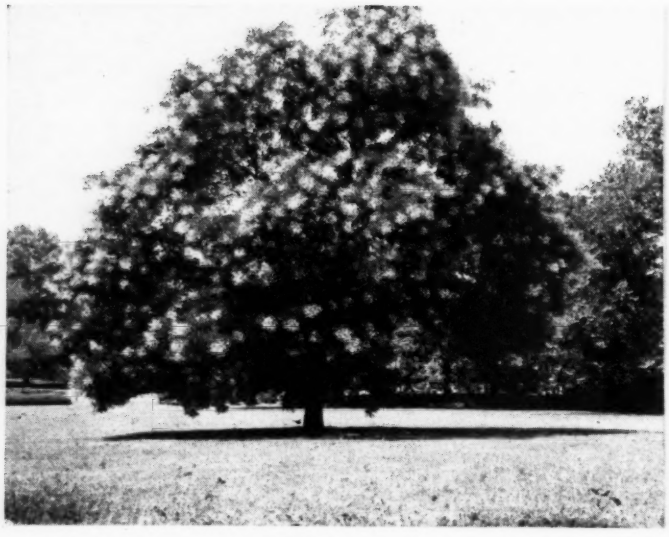
Sources of Gibberellins

Although gibberellins are made by a half dozen or so large pharmaceutical manufacturers, they are available under a great number of brand names. Following are a few of the trade names under which they are presently available in garden supply stores: "Boostabs," "Giant-Gro," "Gibberellic," "Jib," "Mira-cell," "Nutratone," "Plant Shoot," "Plantstim," "Spurt," "Stimucel," and "Wonder-Brel."

E. PLURIBUS UNUM (from page 38)

just sit back and relax and let them grow themselves. In the practice of psychiatry I find that many of my patients do not have a hobby and usually they ask, "What shall I do, doctor?" I take a deep breath and say, "Why don't you grow orchids?" I am pleased to report that some of them have done just that, and all of them have attained some measure of the relaxation that I wanted them to have in the first place. In fact, some of them have become so wrapped up in orchids that they have completely forgotten all their trials and tribulations of the business world, and I believe I should add orchids to the long list of tranquilizers that appear on the market. (P.S. They no longer visit me professionally!)

Would orchid growing be too relaxing, perhaps? Would it have no interest or thrill for those who have climbed the highest mountains? I have a very good friend who used to enjoy shooting rapids and was successful in not losing life and limb in his exploits, but now I am sure he is equally thrilled in growing orchids, and probably more so as each new seedling opens its first flower. Come on in! Shoot the rapids of orchid growing, but be prepared to succumb to it!



Sophora japonica

Phellodendron Lavalei

A SELECTION OF TREES

By T. H. Everett

THE VARIETY OF TREES that can successfully be grown in eastern North America is so great that their very number can become embarrassing when making choices for particular purposes. Both native and exotic species provide this plentitude. Here are a selection of interesting, useful and decorative kinds, all photographed in New York State and most in New York City or its immediate vicinity.

Sophora japonica, the Japanese Pagoda tree or Chinese Scholar tree, given room to develop, grows into a round-headed specimen sixty to seventy feet high. Its pinnate leaves give a soft, feathery appearance to the foliage mass but its chief value lies in that it produces an abundance of large panicles of creamy white flowers in summer. The specimen pictured grows near the Museum Building at The New York Botanical Garden. It is about twenty-five years old.

Robinia PseudoAcacia, the black locust, is a native of eastern and central North America. It is a tree up to eighty feet high with a broad trunk covered with deeply furrowed bark. In late May its creamy white, fragrant, flowers are borne in profusion in drooping panicles. The leaves are pinnate and give the tree a lacy appearance. In fall

Gymnocladus dioicus

Salix fragilis

the leaves become pale yellow. The wood of this species is exceedingly resistant to rot. Unfortunately the black locust is subject to attacks by borers. The old specimen shown is located in the garden of Mrs. C. C. Townsend at Clermont, New York.

Cornus florida, the familiar and beloved flowering dogwood of the eastern United States, is well known. At all seasons it is attractive, not less when in rich autumn color than in spring bloom. Lovely when besprinkled with tiny clusters of bright red berries and pleasing in winter silhouette, this species is one of the grandest American natives. The specimen pictured grows on land which was part of Mrs. Felix Warburg's estate at White Plains, New York.

Albizzia Julibrissin, the mimosa of the South, has long been valued for planting from Washington, D.C., southward. In recent years it has become popular as far north as southern New York but except in very sheltered locations specimens are unlikely to survive so far north if we experience another winter like that of 1934. The tree pictured is at The New York Botanical Garden. *Albizzia Julibrissin* is a native of temperate Asia and grows thirty to forty feet high. It leafs out late, has beautiful feathery foliage and for several weeks in summer produces a succession of flower clusters resembling large pink pompons. This tree requires a well-drained soil.

Quercus Robur var. 'Concordia'

Robinia PseudoAcacia

Phellodendron Lavalei, a Japanese species, is a most excellent kind of cork tree. The specimen illustrated is in The New York Botanical Garden near its main entrance. It is about thirty feet high. Seedlings of this tree were distributed to members of the Garden in 1953 and I have received several favorable reports of the development of the young trees. *Phellodendron Lavalei* is rounded and broad-crowned. Of picturesque appearance, its trunk and branches are covered with thick, springy, deeply fissured bark. Its leaves are pinnate, dark, glossy green and aromatic. The black, pealike fruits, borne in large panicles taste strongly of turpentine. This tree grows best in a deep, rich soil and is remarkably resistant to pests and diseases.

Cladrastis lutea should be more com-

Cornus florida
in flower and foliage

monly planted. It is one of the most beautiful and one of the rarest of eastern American trees. Its trunk usually divides into several main branches some few feet above the ground. Its bark is smooth and silvery and it has a broad, rounded head. In mid - June large, drooping panicles of fragrant, cream-colored flowers are borne in profusion. In fall the leaves turn clear-yellow. This species is generally free from pests and diseases but is liable to storm damage. It thrives in any fertile soil, and occurs naturally on limestone.

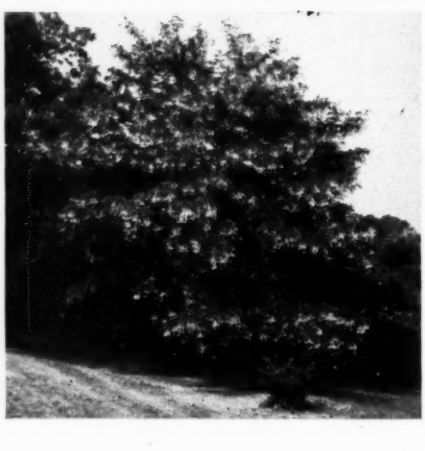
Malus sylvestris is the botanical name of a species that includes the common apple in its many horticultural varieties. Few trees are handsomer or more useful. As an orchard fruit its value is great, as a flowering specimen it is one of the finest spring-blooming kinds, as a shade tree of moderate size it has much to commend it. The picturesque character of the trunk and branching habit of an old apple tree provide one of its attractive characters. The specimen pictured with its trunk near a stone wall is one of many old ones that give splendid character to the garden of Mr. and Mrs. Arthur M. Anderson at Bedford Hills, New York. Apple trees attain maturity rather slowly but even when young are attractive. They succeed best in fertile loams.

Gymnocladus dioicus, the Kentucky coffee tree, here pictured is on the estate of Mrs. Flagler Matthews at Rye, New York. This species is native from western New York and southern Ontario to eastern Nebraska, Tennessee and Arkansas. Despite its wide natural distribution it is not common. The Kentucky coffee tree grows rapidly. It is distinct because of its large, twice-pinnate leaves which are cheerful green in summer and bright yellow in fall, the lateness with which it leafs out in spring, the strong, bony framework of its branch system which shows most clearly in winter and the large pods which female trees bear if a male tree is near. A deep, fertile fairly moist soil suits this tree best.

Salix fragalis, the crack willow or brittle willow, is a native of Europe and northern Asia that occurs spontaneously in eastern North America as an escape from cultivation. It is also planted for ornament. The tree shown here grows at New York International

Upper—*Albizzia Julibrizzin*

Lower—*Cladrastis lutea*



Malus sylvestris
the common apple

Airport. Like most willows, this kind stands coastal conditions well and is adapted for planting near the sea. At maturity the crack willow is sixty feet or more high and of bold and positive appearance, much less soft in its landscape value than the weeping willow. Like most willows, this species grows rapidly and thrives especially well in moist soils.

Quercus Robur var. 'Concordia,' the golden-leaved English oak, is a rare tree. The fine specimen shown here shades a lawn in the garden of Mr. and Mrs. Willcox Adsit, at Ardsley-on-Hudson, New York. The golden English oak is remarkable because its spring foliage is clear sunny yellow. As the season advances, it becomes green but never so dark as that of typical *Quercus Robur*. Unlike some yellow-foliaged trees, there is nothing objectionable in the color of this kind. *Quercus Robur* var. 'Concordia' is propagated by grafting on other oaks. The line of demarcation between stock and scion can be clearly seen a few feet above ground level on the Adsit's tree and is visible in the photograph. I have not been able to ascertain which species has been used as an understock for this specimen.

Evolution of Gardens

By H. W. Rickett

continued from January-February

THE IMPROVEMENT OF PLANTS

Much has been written about heredity: about the chromosomes and the strings of genes in them; and how they are so carefully divided (or duplicated) and handed on intact, through countless generations of cells, so that plants with like characteristics succeed each other in an endless parade. Much has been said also, in recent years, of the improvement of plants, and of "plant wizards" who, presumably through secret knowledge or powers denied to other men, could effect such changes. Both of these pictures contain some truth; both are in some degree misleading.

The genes, though they maintain their identities to an extent which puzzles the chemists, are not immutable. They change now and then. The frequency of such changes can be calculated, for a particular plant or animal and for particular genes. Some change much more often than others; a study of corn revealed that one gene changed nearly five hundred times in a million reproductive cells, while another changed not at all. The frequency of genic changes can be increased, if we subject plants or animals to treatments with X-rays or the emanations of radium or atomic fission. Their causes, however, remain obscure; nor can we generally predict what sort of changes will occur in our experiments. Indeed the majority of the changes which have been studied by geneticists seem to be changes *for the worse*. It has, therefore, been impossible to control the course of evolution, to produce new varieties to order. Instead, the creation of our prized garden varieties has depended largely upon *selection and breeding;* we can watch for heritable changes among the thousands of individuals grown under observation, and select for propagation plants which have new characteristics we like. These may often be "crossed" with each other and with the parental stocks to yield still other combinations, still other new varieties.

Wild sweet peas from Sicily were transplanted into Dutch gardens at the end of the seventeenth century, and shortly thereafter bloomed also in English borders. This species has two or three purple-and-blue flowers to a stalk; the upper petal, the standard, is small as compared to the lateral petals, the wings. White forms, pink forms were noticed almost immediately; other variations were frequent and pleasing. They were selected, propagated, hybridized. Today there are more than seven hundred varieties of the Spencer type alone—the familiar type with large, erect, waved standards; and these embrace hundreds of combinations of many shades of purple, pink, red, lavender, violet. All these varieties came into being through changes in genes, with subsequent selection and hybridization.

Such changes are known as mutations —a Latin word which means the same thing. In 1901 it was applied by Hugo de Vries (it was not original with him; it had earlier been used in various other senses) to some remarkable results of breeding evening-primroses. The offspring of some of these plants differed from the parents in so many ways that they could almost be considered to form new species—what de Vries called "elementary species"; he thought that he had discovered the fundamental pattern of evolution—by large jumps instead of by accumulation through many generations of successive small variations, as Darwin had conceived it. Later it turned out that the evening-primrose story was the result of a very special and complicated sort of behavior of chromosomes and did not really introduce anything new into the genetic stream. The parents were hybrid to begin with, and the "elementary species" only the results of the distribution of groups of different genes among their offspring.

The word mutation, however, survived, being carried over to the small sporadic changes in genes that were recognized and demonstrated early in the present century. The most general current view of evolution is that it occurs partly through a *natural selection* of mutations, these being of all kinds, good, bad, and indifferent, and occurring at irregular intervals. We cannot claim to know the *causes* of evolution, since we cannot connect mutations with known causes in nature. We do know, of course, that evolution occurs in nature as in our gardens—whatever be its causes.

Mutations occur in the reproductive cells. If we want to accelerate the rate of mutation we treat the pollen grains, which are the parents of the male gametes (the female gametes are less easily accessible). The visible results, if any, appear in the next generation. We can also treat the tips of stems, where new parts are formed, for mutations occur also in these cells. In this case we get new characteristics in the plant we treat, without waiting for another generation. But since the mutation occurs usually only in one cell, only the progeny of that cell displays the changed character. In this way we get the chimaeras, a mixture of genetically different kinds of cells in the same part of an organism; one cause of variegation. Such mixtures can usually be perpetuated only by vegetative reproduction.

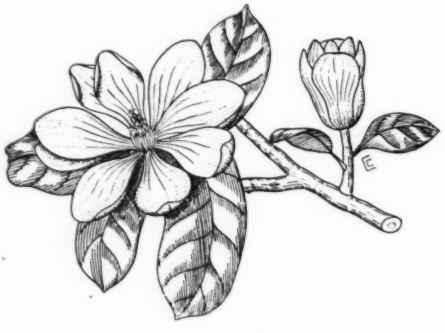
Heritable changes are not, however, all due to changes in genes. Genes are in chromosomes and depend for their normal propagation on the complicated operation of mitosis. [This is clearly described in the author's book, BOTANY FOR GARDENERS. The Editor.] It is easy to understand that this process sometimes goes wrong; in fact, it would be difficult to understand anything else. So the chromosomes are *not* always equally and regularly bequeathed to the daughter cells generation after generation. New characteristics of plants are sometimes due to breakage of chromosomes, which may be then re-united in various ways. It is difficult to distinguish such changes from mutations of genes. Sometimes cells receive more or less than their due share of the parental chromosomes, with resulting changes in the appearance of the plants composed of such cells; these also may be included among mutations.

Plants do not usually do well with *less* than the usual number of chromosomes (the normal number for the species). Flowering plants usually have

two sets of chromosomes per cell, one from each parent. Individuals and even races are known with only a single set in every cell; but these are grown mainly for the purposes of scientific research. They are usually weak and spindling things, of little interest to gardeners. Even the presence of extra chromosomes may sometimes upset the balance which must exist in nature among those powerful centers of activity, the genes; and this may result in failure, in death. But in very many—perhaps the majority—of kinds of plants there are forms or varieties or species with additional chromosomes; even with additional entire sets of chromosomes. These are spoken of as polyploid.[2]

Variation in number of chromosomes occurs even within one plant. Certain parts of the roots of spinach, for instance, are polyploid, having four, eight, or even sixteen sets of chromosomes per cell instead of the two sets found in the meristem from which they were derived. These polyploid cells, however, do not contribute to the next generation, so that they do not concern us here. Polyploidy strictly refers to a duplication of chromosomes which occurs in the gametes and the zygote and is transmitted to every cell of the new plant that is formed from them; or in meristematic cells from which new branches are grown. Sometimes only one chromosome is duplicated: there are three samples of that chromosome in a cell, while other chromosomes are represented by two each. Albert Francis Blakeslee discovered such "trisomics" in the jimpson weed. Sometimes the extra chromosome was formed from two identical halves of one of the other chromosomes, joined end to end. No new genes are contributed by such abnormalities; but the imbalance of chromosomal material is responsible for a changed appearance of the plant. Because *three chromosomes cannot form a pair,* the behavior of chromosomes in reproduction cannot follow the normal course. All the other chromosomes may be sorted out from their pairs in the usual way; but the group of three like chromosomes sends two of its members to one daughter cell or the other (or to neither), so that the number of chromosomes is variable in the offspring. Some are trisomics, some perhaps normal diploids. Stable new varieties are not formed unless an extra pair of chromosomes is present.

Many kinds of plants have a varying number of chromosomes; among them some of the common blue violets. Sometimes the extra chromosomes and genes seem to have little or no effect on the appearance of the plants. In some genera the species differ in their chromosome number; different species of primroses, for example, have eight, nine, ten, and eleven pairs of chromosomes. Such differences may have arisen through the breakage or through the duplication of chromosomes.



If a plant has in all its cells three complete sets of chromosomes (this condition is called triploid), it will not be completely fertile; nor can it, in the ordinary course of gametic reproduction, form offspring consistently like itself; again because *three* chromosomes cannot pair and be regularly distributed to *two* daughter cells. Varieties of this sort, for example, some tulips, must be propagated vegetatively to keep their characteristics.

But if there are four sets (or six, or eight), then the four (or six or eight) identical chromosomes of each kind can and sometimes do arrange themselves in pairs—and peace is restored in the chromosomal family. This has happened again and again in the evolution of plants, so that related varieties or species or even different genera of a family have come to have chromosome numbers in multiples of a basic number. Some species of wheat, for instance, have fourteen chromosomes per cell (seven pairs); other species of the same genus have twenty-eight (fourteen pairs); and still others forty-two (twenty-one pairs). Various species of roses have fourteen, twenty-one, twenty-eight, thirty-five, forty-two, fifty-six chromosomes (those with odd numbers reproduce by some very curious chromosomal tricks which cannot be here described). Again the presence of extra sets, even though no new genes may be present, causes differences in external appearance; often an increase in the size of cells and of the whole plant. It is possible to interfere with mitosis by the use of certain drugs—notably colchicine[3] — in such a way as to cause the chromosomes to "double up"; in this way some of the larger and more florid new varieties (e.g. in zinnias) have been produced for our gardens. In nature it is interesting to notice that polyploidy is more frequent in plants of high latitudes—especially in the arctic, where it may confer some advantage in the severe "struggle for existence."

The connection of hybridization with polyploidy is of particular interest. When closely related plants are "crossed," the offspring contain a mixed assortment of genes which may be variously distributed among *their* offspring—according to the laws discovered by Mendel; with the appearance of new forms and varieties. This is responsible for much of the variation in nature as well as in our gardens. But when the parents that are brought together are not so closely akin—when they belong to distinct species, perhaps—their hybrid offspring may be sterile. It may grow properly (indeed, with a vigor often surpassing that of either parent); but when it comes to form pollen and embryo-sac (which in turn form the male and female cells), the two sets of chromosomes, traceable to the two parents, are so unlike that they do not succeed in pairing, and so cannot be regularly sorted out into haploid daughter cells. Many such sterile hybrids grow in our gardens; they are propagated by their vegetative parts (rhizomes, bulbs, stem cuttings) but are incapable of forming seed. And then occasionally something happens to render them fertile after all. A famous example was the Kew primrose, formed by the crossing of two different species. The cross occurred naturally in 1899 and was made artificially in 1900 and subsequently. On at least three occasions (1905, 1923,

(Continued on page 67)

2 A modern word, formed (badly) by analogy with "haploid" and "diploid." A more correct form would be "pollaploid."

3 The use of colchicine was first suggested by Blakeslee, a brilliant botanist who contributed to recent progress in various fields of botany.

Outdoor Chrysanthemum Culture

By **Spencer Harrison Capreal**

continued from January-February

STARTING SPRING WORK

In March, if the plants were mulched and carried over winter and the weather warms up, loosen the mulch to admit more air. Before the middle of April, remove the mulch unless the temperature is still in the low thirties. If there are sick and dead-looking leaves, pick them off and spray against mildew with a solution of sulphur, fermate, and lindane.

By the middle of April you will be examining your plants for life and growth. If the temperature has been fairly warm before this date, growth will be obvious, or at least there will be some indication of growth. Some plants may appear dead, but do not give up hope — wait a while before pulling them up.

This is the time of year when day lengths are short enough to initiate flower buds if the temperature goes above 50° F. for any length of time, say four to six days. Lighting them in the middle of the night (10 p.m., to 2 a.m.) will prevent bud initiation. A 60-watt bulb with a reflector, placed about three feet above the plants, for each five square feet of ground area, can prevent bud initiation. Reasonably priced clocks are available which can be set to turn the lights on and off for any wanted period.

After plants start growing, you may be disappointed in the number of shoots that appear from which to take cuttings. You may have only two or three stems and would like to have a dozen or more cuttings. Well, there is no reason why you shouldn't have them. Remember, the rooted cuttings are really not wanted until June. Let the stock plants grow until they are eight to twelve inches high. Pinch out the tip and within less than four weeks, vegetative shoots will grow from the leaf axils long enough from which to make cuttings. It would not be too much to say that at least five or six cuttings can be taken from each stem pinched.

Keep soil moist and use liquid fertilizer for quicker and stronger growth. Spray stock plants. If you have made a tip pinch you will be ready to take cuttings before the end of May. Allow about two weeks or a little more for rooting and the plants will be ready, probably before the middle of June, which will be ample time to plant them to their permanent location. A few days or more in a nursery row with some shade will allow you more time in which to transplant.

If time-pinching is practised, plan to put plants out from one to two weeks before pinching date.

TAKING AND ROOTING CUTTINGS

To take a cutting you merely break off the top three inches of a lateral branch between thumb and forefinger. Some growers take them a little longer and some take them shorter.

The process of making rooted cuttings has changed somewhat over the years. In the early days, the lower leaves were removed and the cuttings inserted in sand and even sandy soil. Later, it was found that if the lower leaves were left on, the cuttings would root better and more quickly. The lower leaves supplied an added energy (sugar and starches). Cultured cuttings were recommended. It was found that by allowing stock plants to grow a little taller cuttings would be more likely to be free from any disease the mother plant might have. Dipping the cuttings into a fermate solution was also recommended for disease control but was rejected a short time afterwards, because it was thought that the fermate solution transferred disease from one batch of cuttings to another.

Today, probably the most practical way is to spray the rooting medium with fermate solution, insert the cuttings, and water and spray again with fermate.

Dipping the raw ends of the cuttings in a hormone rooting medium may be of some value. It isn't altogether necessary, however. The care of cuttings is important for a good root system. Keep the medium moist but not wet. Misting several times a day is very helpful; less watering will be needed and stem hardening prevented. Regulated misting does not produce mildew. A misting unit called the "Water Fog," which can be attached to the water hose, works very well for small areas. This misting unit can also be used to overcome transplanting shock when plants are put in their permanent location. It can also be used on hot and dry days when plants lose more water from their leaf and stem surfaces than they can take up from the soil.

You can tell when the cuttings are rooted by a light tug on the stem. If the cutting feels firmly anchored and will not pull out easily, it is rooted. Do not keep them in the rooting medium very long afterwards as it will harden the stem. Spray them again with a solution of fermate and malathion before removing them from the medium.

If their permanent location is not ready and you still have time before the scheduled planting date, place the cuttings in a nursery row.

Be sure all varieties are labelled accurately. Carry labels from rooting bench to nursery row and prepare larger labels for permanent location. A laundry marker or a "greasy" pencil found in garden supply houses will hold all summer and longer.

You probably have a plan ready as to how you will space your plants, say six, seven, eight or more inches apart. Draw a line (Mason's cord) the long way on both sides of your bed. How wide will depend on how far apart the plants are to be spaced. Figuring five plants to each row, these lines should be forty inches apart for eight-inch spacing; thirty-five inches apart for seven-inch spacing; and thirty inches for six-inch spacing or, in other words, five times the distance of the spacing used. Next, provide a board one inch narrower than plant spacing and cut length to fit within the side lines. Put a mark from one line equal to one-half the distance of spacing. Follow through with additional marks at the desired spacing. This board when marked should have one-half the distance of spacing on the ends and full spacing distance between marks. When you start planting, square

(Continued on page 59)

FOUR IMPORTANT RESEARCHES

BY ARLOW BURDETTE STOUT AND THE NEW YORK BOTANICAL GARDEN

By Edmund H. Fulling

The death of Dr. A. B. Stout on October 12, 1957, marked the close of forty-six years association with The New York Botanical Garden. During that period he served the institution in three capacities—Director of Laboratories, 1911-1938; Curator of Education and Laboratories, 1938-1948; Curator Emeritus, 1948-1957 — and earned international renown as a geneticist and plant breeder. Some two hundred new varieties of plants produced by him through breeding and more than three hundred and fifty technical and popular publications from his pen are the fruits of his labor.

Dr. Stout was born in Jackson Centre, Ohio, March 10, 1876. His parents soon moved to Albion, Wisconsin, where he grew to manhood. He attended public schools, had one winter term of study at Milton College and two terms at Albion Academy. For three years he was a teacher in rural schools. In 1903 he was graduated from the State Normal School at Whitewater, Wisconsin, and for the next four years served as a teacher of science in the high school at Baraboo, Wisconsin.

During his tenure at Baraboo, Arlow published two papers in botany and two bulletins on surveys of Indian mounds. He was also much interested in birds, to such an extent that he befriended a young high school student, ten years his junior, who has since acquired fame as an ornithologist and eminent scientist of the Smithsonian Institution—Dr. Alexander Wetmore.

In 1907 A. B. Stout began studies at the University of Wisconsin, majoring in botany under the direction of Professor R. A. Harper. The B.A. degree was granted in June, 1909, at which time he was selected for membership in Phi Beta Kappa; the following year he was elected to Sigma Xi. In 1908 and 1909 he was assistant in botany at Wisconsin; instructor from 1909 to 1911.

In the autumn of 1911 Professor Harper became Head of the Department of Botany at Columbia University, New York City, and for the remainder of his life was intimately associated with the affairs of the Garden. That same year Arlow Stout joined the scientific staff of the Garden and matriculated at Columbia University for graduate studies under the tutelage of Professor Harper. In February, 1913, A. B. Stout was awarded the Ph.D. degree.

Dr. Stout's botanical interests and technical research at the Garden were concerned primarily with experimental studies on the nature and genetics of intraspecific self- and cross-incompatibilities in the sexual reproduction of flowering plants. In those studies he sought to discover the factors that control infertility in various plants, and out of those studies came new strains of plants and increased understanding of plant life. Other phenomena in the Vegetable Kingdom also held his attention, and over a span of forty-five years (1905-1950) his writings were concerned in some detailed manner with a considerable variety of plants.

Dr. Stout regarded four of these many kinds of plants as the objects of his principal investigations — avocados, daylilies, grapes and poplar trees. His work with the first of these led to the revelation of a very unusual type of flower behavior; with the second to increased cytogenetic understanding and the production of new, horticulturally valuable, herbaceous perennials; the third, also to greater cytogenetic knowledge and to the production of fruits that may some day be important in vineyards of the eastern United States; and the fourth to the production of hybrid trees that, in time to come, may have monetary value in excess of all the cost incurred by his researches.

It is fitting at this time, not only as a tribute to Dr. Stout as a scientist but also in an effort to evaluate and to call attention to these four fields of investigation, that a somewhat detailed account of them be given and an effort made to determine and record the present status of those projects. Selection of these four for particular consideration here must not, however, detract from the significance of his many other investigations, among which were studies on apples, autumn coloration, chicory, Chinese cabbage, dates, geraniums, hemlocks, lilies, lily-of-the-valley, maples, oaks, petunia, plantain, potatoes, sweet potatoes and tulips.

Daylilies

It is often by some experience or observation in youth that lasting scientific interest is engendered. So it was with A. B. Stout at twenty-one years of age in 1897 when, at one end of the porch of his home in Albion, Wisconsin, there was a clump of the old familiar fulvous daylily and at the other end a colony of tiger lily. These two groups of plants had the most conspicuous of all the flowers about his home, and the numerous blossoms every year were perfect, that is, they had well-developed stamens and pistils. Arlow had learned to observe this as a result of his first formal study in botany the previous year at Albion Academy where Asa Gray's How Plants Grow led him to expect that abundant fruits and seeds would form from such well-developed flowers. But Arlow's blossoms did not produce any fruit at all; in fact, as he later learned, those two kinds of plants had never been known to produce seed in their entire history of cultivation. The anomaly perplexed Arlow, and fifteen years later an opportunity was presented for him to begin investigating the problem. That was in 1912, the year after he became associated with the Garden. For thirty years thereafter he studied the problem, being concerned not only with acquiring a cytological and genetical understanding of sterility in these plants but also with the possibility of producing, by hybridization and selection, flowers of color, form and other features different from the yellow and orange-shaded ones already known for several centuries. It is with the pursuit of this project, more than with any other of his many fields of investigation, that Dr. Stout is identified as a plant breeder, a cytologist and a geneticist.

A requisite for this work was as nearly complete a collection of species, varieties and clones of daylily as it would be possible to assemble. Dr. Stout began this aspect by obtaining plants of the common fulvous daylily from various localities in the United States and from other countries as well, and developed an extensive correspondence with daylily fanciers in Europe, Japan and China. Through such correspondence in the twenty years prior to 1942, The New York Botanical Garden received more than fifty collections of living plants and seeds of *Hemerocallis*, the daylily genus.

As the wild forms and many clones thus assembled over the years flowered, Dr. Stout carried out pollination work. By 1919 several thousand such controlled crossings were accomplished, and capsules and seeds obtained from *H. flava*, the common lemon daylily, and by hybridization of *H. flava* and *H. Thungergii* X the common fulvous form (*H. fulva* clone 'Europa'). Until four capsules were thus acquired out of several thousand pollinations, the widely cultivated orange daylily had not been known to yield fruit and seed to any kind of pollination, self or cross.

Cross-pollinations were continued in subsequent years, and in Dr. Stout's own words:

> "Hybrid daylilies in considerable number were blooming in 1923 and various persons who saw them advised that they be distributed for garden culture. In 1924 Dr. N. L. Britton, Director of The New York Botanical Garden, considered this matter quite fully and decided that the Garden can not propagate daylilies either for general distribution or for sale and that cooperation with

some reputable nursery firm should be obtained for the introduction of the new selections. Various nurserymen in the vicinity of New York City, some of whom had favored the Garden with contributions of plants, were approached but not one of them was willing to cooperate in testing and propagating the most promising seedlings of these daylilies.

"Letters were then written to more remote nurserymen but the only response came from Bertrand H. Farr, who soon came to inspect the new seedlings. He offered to cooperate in introducing them to the trade. After his death in the following autumn the nursery company which he had established continued in the cooperation, the fundamental aims of which are (1) to evaluate selections critically, (2) to propagate the selected seedlings during the period of trial and evaluation, and (3) to make the best of the selections available to a considerable number of persons at the time and at a relatively low price."

By mid-1926, 7,135 flowers of *H. fulva* had been cross-pollinated and twenty-three capsules obtained in over ten years work. Those capsules contained seventy mature seeds which yielded eleven seedlings. At that time there were two other records by other breeders of *fulva* seed, since the clone had first been described in 1576.

By the end of 1941, seventy thousand pedigreed seedlings obtained through Dr. Stout's work in twenty-nine years had been grown, several thousand of them, at one time at least, at "Skylands," the estate of Clarence Lewis, a member of the Garden. From all those seedlings, some five hundred were selected for further breeding. From 1930 through 1941, forty-eight new horticultural clones, selected from Dr. Stout's hybrid seedlings, and one new species *(H. multiflora)*, obtained from an importation, were distributed to the trade through the Farr Nursery Co., of Weiser Park, Pa. By October, 1942, another new species *(H. altissima)* and one botanical variety *(H. fulva rosea)* were described from Chinese importations. Additional clones were introduced by Farr in 1949, and eleven more were described by Dr. Stout as late as the January-February 1956 issue of The Garden Journal.

Up to 1935 Dr. Stout's daylilies were grown in the former propagating area near the Allerton Avenue entrance to the Garden. That year the work was transferred to the large area behind the Museum Building. A display collection was laid out there and built up in subsequent years to contain plants of all known thirteen or fourteen species of *Hemerocallis* and of all obtainable, previously known, horticultural clones as well as Dr. Stout's selected hybrid seedlings. Several of the species representatives were obtained from the wild in various localities in Japan, China, Manchuria and Siberia. The assemblage eventually became the nearest complete of all daylily collections, containing, in 1937, about two hundred and seventy-five named horticultural clones, the number that had been produced since 1890 when hybridization of daylilies was begun in England by George Yeld. The collection was built up through 1936, and then it was decided to make no more additions to it, but to devote the time and facilities to research and other pressing matters.

Dr. A. B. Stout
taking notes on his daylily breeding.

It was a familiar sight, summer after summer in the daylily flowering season, for Dr. Stout's colleagues in the Museum Building of the Garden to see him, in sun helmet and seated on a stool, pollinating his lilies in this extensive collection, tagging the treated blossoms and recording his copious observations and manipulations. He kept his records in several large loose-leaf volumes, and toted them in a wooden receptacle resembling a carpenter's portable tool box. Sometimes he worked in the nursery alone; more often, one or two assistants were with him. Of these assistants, the longest tenure was that of Dr. Clyde Chandler who served as his technical assistant from 1927 through 1943. Dr. Chandler has since become associated with the Boyce Thompson Institute for Plant Research, but during those sixteen years it was she who supervised the laboratory work in connection with the cytological studies on daylilies, made many of the more difficult preparations and preliminary studies of the material, and took the photomicrographs that became a part of Dr. Stout's publications.

Between 1920 and 1936 at least five thousand of the best seedlings of some fifty thousand discards were distributed to Garden members, particularly to some of those who had contributed to the support of the Garden. It was soon learned that some of these plants were obtained by nurserymen and by breeders and, in some cases, were sold as named clones. In one instance, seeds of narrow-petaled and red-flowered plants of these discards were advertised and sold at ten cents each, and divisions of the plants for as much as $9.00. Distribution of discarded seedlings was discontinued after 1936.

The display garden was continued until 1948, and each year was inspected by numerous casual visitors and by many gardeners who had a special interest in daylilies. Seeds in considerable numbers were collected by such visitors, especially from the clones produced at the Garden. Guards were not always on duty, and plants were frequently removed surreptitiously, even from the selection bed. Seeds were even taken from tagged capsules of special breeding, and one plant breeder cheerfully admitted to Dr. Stout that a group of seedlings in his garden originated from such pilfered seeds.

In the summer of 1948, according to a memorandum left by Dr. Stout, collections of named species of *Hemerocallis* and of the named clones that had been produced at the Garden were sent to the Sarah P. Duke Garden at Duke University, Durham, North Carolina; to the Missouri Botanical Garden, St. Louis, Missouri; to the Botanical Garden of the University of California, Berkeley, California, and to St. Michaels College, Winooski, Vermont.

The remainder of the collection at the Garden was transferred, also in

1948, to the Farr Nursery. In December, 1949, about three hundred selections were under evaluation at that nursery, in addition to about one thousand seedlings from seed obtained by Dr. Stout that had not yet flowered. That same year Dr. Stout obtained about three thousand seeds from semi-double, pink-flowered and red-flowered selections, and the seedlings from these were being grown by the Wayside Gardens Company. It was planned that the Farr Nursery and Wayside Gardens would cooperate in evaluating and introducing such additional clones as might be desired with respect to their values and to conditions of the horticultural market.

Dr. Stout visited the Farr Nursery in subsequent summers as late as 1955 to make selections. According to a letter, dated November 18, 1957, from the Farr Nursery, Dr. Stout named and that nursery has introduced a total of eighty-three clonal varieties of daylily. These represent the final selections from some one hundred and fifty thousand hybrid seedlings acquired over the years. In addition, the Nursery reports, there remain for them to introduce, pending sufficient increase in stock, Dr. Stout's twelve selections from a new race of doubles which he developed from mutations, and also his selections from a group of fall bloomers.

No financial agreement was ever made between The New York Botanical Garden and Farr Nursery regarding compensation for their acquiring exclusive right to propagate and distribute Dr. Stout's creations to the trade. In recognition of their commercial value, however, and of Dr. Stout's skill and devotion in producing them, the Nursery offered to pay Dr. Stout a royalty. This was declined by Dr. Stout, whereupon the Farr Nursery voluntarily undertook to contribute to the Garden ten per cent of gross receipts realized from the sale of Dr. Stout's creations. Such voluntary contributions were received by the Garden from 1939 through June, 1954, and have been reserved as a "Hemerocallis Fund." This fund has been called upon to defray various expenses in connection with Dr. Stout's daylily work, and during the years mentioned amounted to over $4,800.

Before Dr. Stout began his breeding work with these perennial favorites of

'Theron,' the first dark red daylily, was bred by Dr. Stout.

gardens, far and wide, their color range extended from pale yellow through shades of yellow and orange to combinations with fulvous red. In his hybrids which are now in the trade this range has been extended, especially into rosy pink, red and purplish shades. Notable among these was the first dark red daylily, named 'Theron' in 1950.

In addition to the actual work of breeding daylilies, of supervising maintenance of the display nursery and of directing the technical laboratory work of his assistants, Dr. Stout wrote voluminously on the subject. According to an annotated bibliography of these writings, which he compiled in December, 1949, and deposited in the Garden library, Dr. Stout was responsible for ninety-seven technical and popular contributions which deal partially or exclusively with *Hemerocallis*. Among them is a 119-page semi-popular general treatise of daylilies, but all of them, it should be noted, account for less than one-third, numerically, of his botanical writings.

Recognition of Dr. Stout's meritorious labors in connection with daylilies has been at least five-fold. First, there was an award in 1937 of the Thomas Roland Medal of the Massachusetts Horticultural Society. The next year he received a gold medal from the Horticultural Society of New York. Thirdly, in 1939, one of the William Herbert Medals awarded that year by the American Amaryllis Society went to him. In 1950 he was the first recipient of the Bertrand Farr Annual Award of the Hemerocallis Society to be given to a *Hemerocallis* hybridizer. This Society, furthermore, established the Stout Medal to be awarded each year for a clone of *Hemerocallis*. In 1954 this award was voted to the 'Dauntless' daylily developed by Dr. Stout. And lastly in 1954 The New York Botanical Garden presented a Distinguished Service Award to him for "outstanding contributions to horticulture and botany."

In connection with the awarding of the William Herbert Medal by the American Amaryllis Society, Dr. Stout was requested to prepare an autobiographical sketch which he did. This account was published in Herbertia (6:30-40. 1939) and provides interesting reading, especially for those who knew Dr. Stout personally.

Dr. Stout, to be sure, was not the only plant breeder who developed varieties of daylilies. Such hybridization was begun about 1890 in England by George Yeld. Others in Europe and some in the United States, including Luther Burbank, also contributed. Appropriate recognition of their roles is given by Dr. Stout in his book on daylilies, and also Philip G. Corliss, M.D., in his book, HEMEROCALLIS — THE PERENNIAL SURPRISE, published in 1951, pays tribute to these other breeders, but then he adds:

> "The greatest name in the development of modern hybrid daylilies is that of Dr. Arlow B. Stout. Many forms of plant life have received attention from this great horticulturist but his monumental work has been with daylilies."

AVOCADOS

By the second decade of the twentieth century an avocado industry was established in California and Florida, but numerous growers of the trees in those states were threatened with financial loss because many of their plants flowered abundantly but produced fruit very irregularly or not at all. A study of the situation in Florida by B. S. Nirodny was published in the Annual Report of the California Avocado Association for the year 1921-1922. It concluded, among other matters, that failure to set fruit was caused by inadequate pollination. Nirodny called attention to a decided lapse in time between shedding of pollen by avocado

flowers and receptiveness of their stigmas for pollen. Such separated maturation in the sex elements of flowers is known elsewhere among plants and is referred to as "dichogamy."

It was this first explanation of avocado sterility, very likely, which induced the California Avocado Association to invite Dr. Stout, thirty-five years ago, to make a study of flower behavior in avocado in that state and to relate such behavior to the problem of sterility which confronted them. Dr. Stout accordingly undertook such studies in the winter and spring of 1922-1923 in cooperation with the officers and various members of the Association and under the auspices of Pomona College, where he spent the academic year as a visiting member of the faculty. In 1925 he extended his studies to Florida under the auspices and with the financial support of The New York Botanical Garden and the Farm Bureau of Dade County, Florida.

In those studies Dr. Stout not only found the explanation of avocado sterility beyond the stage to which Nirodny had elucidated the matter, but he thereby revealed one of the most unusual types of flower behavior in the entire Plant Kingdom, the like of which had not been observed in any other plant and may not yet have been found elsewhere. Dr. Stout's technique in revealing this anomaly was intriguing in its simplicity, for all that it involved was putting small tags on hundreds of individual blossoms, carefully observing how those blossoms behaved and then deducing accurate conclusions. Simple though the procedure was, it required lengthy observations from early to late in the day during the flowering season of avocado orchards.

Dr. Stout's publications on these investigations provide interesting reading in flower behavior and reveal how an understanding of such an otherwise academic subject may yield a solution for a financial problem. In brief, his studies showed that the development of the male and female parts of avocado flowers is such, with respect to timing, that self-, close-, and certain cross-pollinations are, for the most part, prevented and are not to be depended on for fruit production. More explicitly, the situation is as follows:

1. Every flower on an avocado tree has two periods, of several hours each, during which it is open, separated by a period of being closed; in the first period of being open it can function only in a female capacity, having a receptive stigma but anthers which do not shed pollen; in the second period it can function only in a male capacity, shedding pollen but having a brown, shriveled or at least non-receptive stigma. Since ninety percent or more of the flowers which are open at any one time on any one tree are all female-functional or all male-functional, and since there is a distinct interval of several hours between the two periods, in which interval the blossoms are closed, there is little or no overlapping of open male and open female flowers and, consequently, little or no chance for the flowers on any one tree to pollinate either themselves or one another.

2. Every tree of any one variety of avocado behaves exactly alike with respect to flowering. Consequently, in orchards planted with trees of only one variety, all open flowers on all the trees at any one period of several hours are exclusively female-functional or exclusively male-functional, for the most part, and, since there is little or no overlapping of the periods, there is little or no chance for cross-pollination between the trees.

3. About one-half of the cultivated varieties of avocado studied so far produce their first-opening, female-functioning, flowers during morning hours, their second-opening, male-functioning flowers in the afternoon; all the other varieties display a reverse of this, that is, the first-flowering, female, blossoms open in the afternoon; the second-flowering, pollen-shedding ones in the forenoon. Furthermore, the afternoon male blossoms are not the same blossoms that are female in the morning of the same day, but those of the previous day. In other words, the varieties in the two groups reciprocate with respect to their daily alternations of sex—the variety 'Taylor' in one group, for instance, is female while the variety 'Panchoy' in the other group is male, and then while 'Taylor' is male, 'Panchoy' is female, all during the hours of a single day.

On the basis of these findings, Dr. Stout advised that single-variety orchards no longer be planted, and that in those already established there be made interplantings of other varieties, selected so that pollen-producing blossoms would be open on some trees at the same time that stigma-receptive blossoms would be open on other trees. Such interplantings would increase the chances for the necessary pollination, and if provision were made for bees, the principal pollinating agents, those chances would be increased still more and greater crops would result.

The solution of the avocado sterility problem was not as simple as is implied in the foregoing very brief summary of Dr. Stout's findings. He, himself, called attention, for instance, to the fact that incompatibility between varieties may prevent fertilization and consequent fruit development despite adequate pollination, and that variations in weather conditions very definitely alter the rhythm of reciprocal male and female flowering which is so well developed under ideal conditions. Nevertheless, Dr. Stout's explanation of avocado sterility was well received in the California and Florida industries and was given publicity in the local newspapers of those states. California residents were enlightened on the matter by Dr. Stout's own lengthy feature articles in the Sunday editions of the Los Angeles Times (April 29 and July 8, 1923, and April 24, 1927) and in the California Cultivator (May 5, 1923, and January 5, 1924). The favorable reception which his work and these articles received is indicated by the following editor's comment which prefaced his article of July 8, 1923:

> "Dr. Stout's investigations in the field of avocado pollination . . . have been the sensation of the year in Southern California horticultural circles . . . Such practical research work, properly followed up by the growers themselves, bids fair to open a new era in avocado culture."

And in further recognition of his service to the industry, the Board of Directors of the California Avocado Association unanimously resolved on June 15, 1923, to express its appreciation of his work.

As a contribution to flower biology, Dr. Stout's investigations of avocado will always be significant, but his recommendations regarding interplanting as a means of obtaining greater crops

(Continued on page 53)

Ferns

By Walter Singer

Holly fern, *Cyrtomium falcatum.*

THERE IS SOMETHING DELICATE and graceful about a fern. Either on the weather side of a tropical mountain covered with tree-ferns or in the cold northwestern Canadian Rockies with ground cover ferns, somehow we are pleasantly attracted by their lacy foliage. Maybe it is the same feeling or sensation we experience when looking at filigree jewelry or exquisite Belgian and French lace.

Even though fern foliage is not colored brilliantly as is a coleus or croton, and even though ferns do not produce bright-colored flowers—as a matter of fact, they never have any flowers — ferns have stayed in our gardens and homes while other house plants at one time more fashionable have come and gone. Yet ferns are not grown as often as they were.

There are reasons for the limited popularity of ferns. The main reason, unfortunately, lies directly at the source of all evil. For the commercial grower the culture of ferns is not an easy one in comparison with other crops which can be produced as quick "turn-overs." More and more good house plants are disappearing in this way. Growing ferns from spores has nearly stopped; only a very few growers still grow ferns from spores, since this method requires skill and time. But even growing ferns by division is almost non-existent today, as other crops take less time to grow and are, therefore, more profitable. Finally, the selection of ferns suitable for the house has not always been the best, even by the men who should know.

There are thousands of ferns growing in woodland areas which range from the coldest regions of the north to the hottest tropics, but not all are suitable for our living rooms. Of course, it is difficult to create a woodland in our broadloom-carpeted living rooms as far as humidity is concerned. The fine constant mist of a rainforest would soon enough become disastrous to ourselves and the neighbors below. However, there are ways in which we can try—by placing some of the sensitive ferns in a terrarium or by settting the potted ferns in trays filled with pebbles or sphagnum moss. Filling these trays with water from time to time will create a considerable amount of humidity right around the potted ferns. Ferns like to be kept moist but not wet; good drainage will prevent water-logging.

Proper lighting is easier to accomplish than the right humidity. In the hot summer we have to be especially alert and watch that the fern fronds will not be burned by direct sunlight during the middle of the day. Occasional liquid feeding keeps ferns healthy and fresh green in color.

By far the most popular fern is the Boston-fern *(Nephrolepis exaltata bostoniensis)* with its many forms and variations. Some of these grow into large specimens; others are slow-growing such as 'Verona' and *Whitmanii*, which have finely feathered and wavy fronds.

Birds-nest fern, *Asplenium Nidus-Avis*

Another old-timer is the birds-nest fern *(Asplenium Nidus-Avis)*. The center of the compact rosette of leathery strap-like leaves looks just like a bird's nest, especially before a new frond unrolls. Very attractive is the linear spore structure on the underside of the glossy leaves.

Years ago fern dishes or jardinieres were quite fashionable. For such an arrangement usually a variety of table ferns was planted into a fancy dish. Ferns may keep that way for a while, but it is far more advisable to plant table ferns in a terrarium where they will thrive for a long time. Some of the brakes *(Pteris)* are very suitable and attractive for such plantings.

A few years ago a fern novelty was brought out — the squirrel-foot fern grown on a tree-fern stump, usually not exceeding ten to twelve inches. This

Above, *Pteris albo-lineata.*
Right, Squirrels-foot fern, *Davallia bullata Mariesii.*

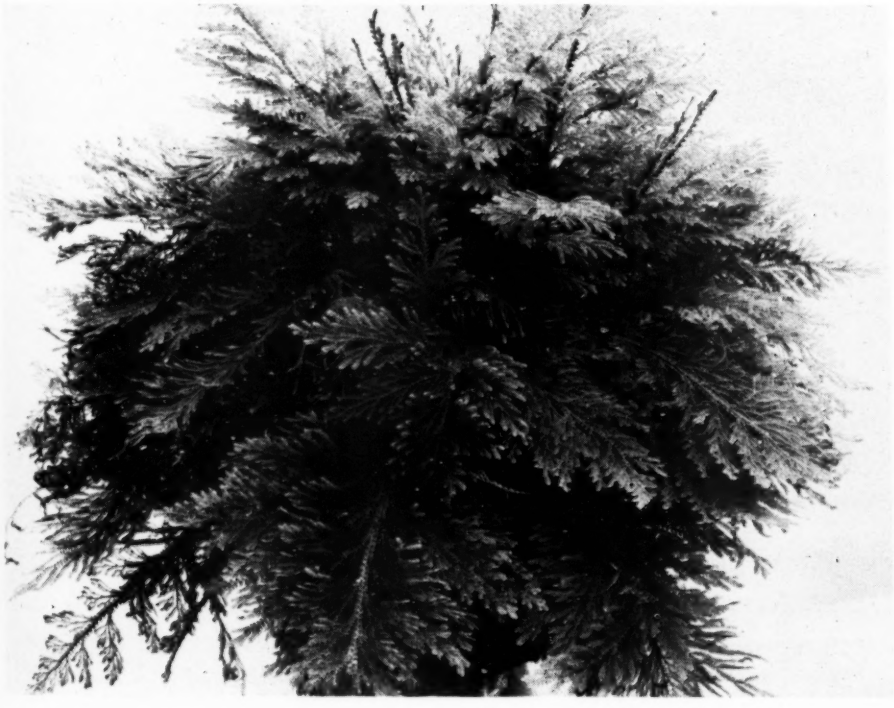
Above—
Young plants of the staghorn fern.

Right—
Staghorn fern, *Platycerium alcicorne (bifurcatum).*

Below—
Selaginella Emmeliana, a fern-like house plant, but not a true fern.

fern, *Davallia bullata Mariesii*, comes from Japan where it is used to cover pillars or is planted up in handsome baskets. Its brown-haired rhizomes resemble a squirrel's foot, while the foliage is especially lacy and graceful. Instead of growing it in a flower pot, the fern stump is set in a saucer or dish filled with pebbles and water.

The staghorn ferns compose another group which can be grown on some kind of support, be it bark, fern stumps or even plain board. Sometimes these supports can be made quite fancy — or the containers used to hold them may be such as to make a staghorn fern an eye-catching conversation piece. The oddly-shaped fronds have given this group of ferns its name. Most of the staghorn ferns have thick leathery fronds, silvery gray-green; the underside of the frond is covered with a silvery cotton down. Staghorn ferns keep very well and require little care. *Platycerium alcicorne (bifurcatum)* is probably the most favored among them.



The most graceful, and at the same time the most delicate of all house ferns are the adiantums or maidenhair ferns. Their thin stems and delicate leaf texture certainly make them the fair ladies (maiden) of the fern families. Adiantums should be kept warm, especially in the winter; they are very sensitive to cold, drafts, overwatering.

The holly fern *(Cyrtomium falcatum)* seems to do well in a slightly cooler atmosphere. Its fronds are stiff and almost erect. The dark green leaflets are glossy and saw-edged, resembling small holly leaves. There is a handsome dwarf variety, *C. falcatum compactum*, which is especially suitable as a house plant.

Fern propagation by spores.

Most florists have one or two large cibotiums in their window or shop. This tree-fern, native to Central America, grows to large dimensions, but when young makes a good house plant for quite a few years.

There is a group of plants that everybody calls ferns, although botanically they are not classified as true ferns; rather allied to ferns. They are the selaginellas. Most of them are used commercially in terrariums and are seldom seen as single specimen plants. There are two selaginellas *(S. Willdenovii* and *S. uncinata)* which are outstanding for their true-blue irridescent foliage. *S. uncinata*, the smaller of the two, is suitable for terrariums and a delight to look at when in good blue color. Two other selaginellas are known in the trade: *S. Emmeliana*, a fern-like specimen, is sold as a small house plant, while *S. Kraussiana Brownii*, a moss-like plant, is used in almost all terrariums.

Before closing the fern story, two plants should be mentioned which are always called ferns. They are the asparagus "ferns," *Asparagus Sprengeri* and *A. plumosus*. Both are sisters of the asparagus we eat. They are not even distantly related to ferns, but their fine feathery foliage probably led erroneously to the name fern. Both species were among the top-ranking house plants of Grandma's era. Today these plants are grown by the acre in central Florida for "cut ferns" to be used in bouquets and other flower arrangements.

Fern propagation by division.

FOUR RESEARCHES (from page 55)

through greater pollination have not found support in the experience of either California or Florida avocado growers. Most plantings today in both states consist of different varieties in solid blocks. Where varietal interplantings have been made, it has not been possible to demonstrate any significant increase in yield; and harvesting operations, at least in California, are regarded as less efficient when it is necessary to cover the same ground repeatedly to pick fruits maturing at different times. The little interplanting that is done, is carried out for reasons other than that of intentionally providing cross-pollination. Some growers, for instance, interplant two varieties with the intention ultimately of removing the less productive of the two; others regard single-variety plantings as undesirable because of the short bearing season of any one kind.

Why has it been found unnecessary to increase pollination in avocado by varietal planting in order to obtain commercially remunerative crops when Dr. Stout demonstrated the beautiful dichogamy that exists in these trees? Basically it is because avocados are exceedingly floriferous in most varieties, so much so, that the five to ten percent

of the female-functioning and male-functioning flowers which overlap in being open at the same time is sufficient to provide pollination for good crops, even though only two to four percent of that five to ten percent result in mature fruit; all other factors must, of course, be favorable. A thousand or more blossoms may be borne on a branch less than a foot long, space for not more than two good-sized fruits, and if a 'Fuerte' avocado, for instance, sets one fruit for every five hundred flowers, it provides a good harvest. Isolated trees of this popular variety in California are often observed to set fruit as well as trees in mixed plantings, and in Florida the same is true of 'Lulu,' 'Taylor' and 'Waldin,' three of the leading varieties grown there.

As a final word in this evaluation of Dr. Stout's recommendations, it must be noted that, while recent literature on the subject and correspondence with Calavo Growers of California, as well as with the Florida Agricultural Experiment Station, emphasize that good crops are obtained without provision for cross-pollination, they seem to regard interplanting as a safety measure.

To be continued

OUTDOOR CHRYSANTHEMUMS (from page 51)
up first row and plant. Then use planting board, placing it in front of the first row and follow through, planting on the marks. By leveling the ground as you go along, the bed will end with a very neat appearance.

The problem of keeping plants growing straight is always a burden. Staking and tying are tedious and time consuming. An arrangement, Illustration 2, as shown in page 69, will save time and probably be less expensive than stakes when a fair number of plants are grown. It is advisable to put these pipes up before planting, spacing them just a little wider than the lines. The cross bar is adjustable; it can be stretched tightly the long way, between and on the outside of the plants. To provide a pocket which will hold each plant in place, and using the spacing you have chosen for your plants, tie medium heavy twine to one outside line, taking it under and across each wire to the other side and securing it to the opposite outside wire. To keep these lengthwise wires apart, notch a wooden lath or thin board at the desired intervals and slip it over the wires. Raise the cross bar at both ends as the plants grow. The pipes in Illustration 2 can be bought elsewhere, but the fittings are exclusive with Lord & Burnham, Irvington, N. Y.

Starting Summer Schedule

Watering, fertilizing and spraying for disease and insects are important for excellent results.

Keep soil moist—not wet.

Be careful and timely with fertilizers. (See recommendations, Part I.)

Spraying weekly for disease and insects; this is good insurance. (Chemical recommendations in Part III.)

The date for time pinching will arrive quickly. Soon after pinching, vegetative shoots will appear at leaf axils. After they have grown a bit, save two to four of the stronger laterals and pinch the others off.

By July, or even before, you may notice crown buds coming out; remove them. These buds were probably formed in the mother plant before cuttings were taken.

Beginning the latter part of August, buds will start showing on early-blooming varieties first, followed by later-blooming varieties. Crown buds will show first and gradually terminal and secondary buds will appear.

The exhibition types are usually the ones to be disbudded for one large bloom. You may wish to save a crown bud or one from a terminal cluster; rub off all other buds and any that develop later. A close acquaintance of mine tries this little trick: she disbuds to three, sometimes two buds, and watches the race for supremacy among them. When one seems to surpass the other in size, the two are left for a while, "just in case of an accident," and then the smaller one is carefully removed "so the larger one won't develop a wry neck."

Just before color shows in the buds, stop fermate and add parzate to the spray formula to prevent discoloration on blooms.

Stop using liquid fertilizer a week or ten days before flowers are in full bloom. Stop watering a week before blooms are in; but if the ground is very dry, water just enough to keep the leaves turgid.

Watering and fertilizing to the day blooms are cut can soften and shatter petals, when the plants are handled.

After flowers are all cut, the leaves on the ground should be picked up and burned. The plants to be carried over winter should be transplanted to an area where water drains off easily. A three by six foot frame, eight or ten inches high, will hold as many as eighteen varieties and give protection. Keep the labels with each variety—remember, each variety has a personality all its own as to growth habit.

Mulching is a great help for winter carry-over. Salt hay, evergreen branches and agricultural glass wool make good mulches but must be taken off in the spring before the weather gets too warm. Otherwise, you may have a mildew condition. At our place we use frames to test for winter kill and to hold other plants for which there is no room in the sash house. Instead of a mulch, we use lath strips cut and spaced their width, nailed to one by two-inch stock. This forms a sort of three foot by three foot area, and two of these are placed over our three by six foot frames after the ground freezes. We find this works quite well for the hardy garden varieties, and there is no need to worry about mildew. To get the greatest good out of these lath assemblies, place them to face north and south. The spacing between them will allow the sun to filter through fifty percent of the time and help to prevent the ground from thawing out too quickly.

Plants that already show healthy shoots coming up above ground, and those which, when pulled up, have rhizomes growing out of the roots, are the ones to carry over winter; others are hardly worth saving.

We have, so to speak, completed the cycle of growing chrysanthemums out-of-doors from cuttings to cut blooms and if you are faithful in carrying out the summer program schedule, the results should be thoroughly satisfying. If, however, after all your hard work, some of the plants did not perform well, any one of a number of things may be responsible. Let me review these important points:

WATER, can be an important factor in spreading disease. Rain or overhead watering makes it possible for soil-born disease to splash on the stem

(Continued on page 69)

HOLDEN ARBORETUM

By Lewis Lipp

Stream bordering the Arboretum

MANY horticulturally-minded people have their eyes on the Holden Arboretum and rightly so, for few arboretums today have the accumulation of features which can be found here. The Arboretum is located in a small community of private homes and yet is only twenty miles east of Cleveland in Kirtland Hills, isolated completely from the ever-present industry that is rampantly springing up throughout this country. The Holden Arboretum consists of abandoned farm lands of alluvial clay, traversed by small streams, gullies, hills, and deep ravines. Best of all, there is room in which to expand. In fact, the Arboretum was expanded as recently as December 16, 1957, when through the gift of S. Livingston Mather of Cleveland, Ohio, Stebbins' Gulch was added. The vast gulley, so deep and shaded that even on a very hot day the temperature does not rise above 75°, abounds in plants not commonly found in Ohio and is, therefore, of great interest to naturalists and botanists. This three hundred and sixteen acres of tangled wilderness brings the total acreage of the Holden Arboretum to over fourteen hundred acres.

On a fair day, one can scan the pleasing landscape and view the blue margin of Lake Erie with its ore boats laboring to port. In its close proximity to the lake, this Arboretum is extremely fortunate, for the climate is comparatively cool and moist with an average rainfall of about thirty-four inches and a growing season of approximately two hundred and two days. Further evidence of this favorable location is proven by the phenomenal growth of commercial nurseries within the county, one hundred and eighty strong and including many well-known establishments.

While the development of the Holden Arboretum has been under private management, in 1950 an area was set aside for the purpose of establishing, in cooperation with the Department of Forestry of the state of Ohio, a demonstration farm wood lot. And more recently in 1956, a substantial tract of cleared land was set aside and is in the process of being planted with hardy, nut-bearing trees in conjunction with the Northern Nut Growers' Association. To date eighty-seven nut trees have been planted where they will receive perpetual care.

Visitors to the Holden Arboretum must travel at a slow pace over a dusty, washboard, country road to reach its gates—but who wants to hurry? Within the Arboretum there are practically no roads. Dirt roads, however, lead to large off-street parking, for the intention is to keep the area in a natural state as far as possible. If an individual is enthusiastic enough to drive this distance, he should be delighted to stroll over the well-kept grass paths that stretch forward through the plant collections. There are also extensive trails for the meandering hiker and a bridle path for the horseback rider. Luckily, the Holden Arboretum has had no fires since it was established in 1931, and vandalism is practically unheard of.

We take special pride in the remaining forests of beech-maple, Appalachian and midwestern oak-hickory with their fine specimens which have become a curiosity and source of wonder because of their size.

An examination of our plant records discloses well over three thousand species, hybrids, and varieties entered within the past three years. Each year an average of six hundred trees and shrubs are planted in permanent places throughout the Arboretum.

Several acres are devoted to man-made lakes and ponds which, in a way, are unprecedented for an arboretum. These bodies of water have several special functions. They are invaluable for irrigating the newly-set trees and shrubs and provide adequate fire protection. Year in and year out, Canada geese, wood ducks and mallards descend upon Corning Lake. Here they sense the wildness of the setting with the peacefulness of evergreen hills, open fields and an occasional glimpse of deer. These bodies of water are a valuable asset in attracting new members, for members have the privilege of fishing at the Holden. The lakes are well stocked with bass and blue gills, which are comparable in size to those found in many earlier ponds in the state of Ohio.

We have inaugurated a service which is unique. As soon as we receive a new and worthy acquisition, a sizeable num-

Broad, sweeping view of Holden Arboretum towards Lake Erie.

ber of cuttings, scions or budwood are sent to arboretums, botanic gardens, and nurseries which have cooperated with the Holden. This is, after all, one of the primary purposes of an arboretum. Under this procedure a wide selection of plants becomes available earlier to the growing horticultural public than through out-of-date customs. There are, of course, exceptions: the procedure does not apply to patented plant material, and material donated by nurserymen is sometimes accompanied by a request not to distribute. The Holden Arboretum is aware that not many nurserymen are able to keep abreast with new plant introductions, nor do they have direct contacts to obtain them; so, while this is a heavy responsibility to undertake, the Holden Arboretum is fast earning respect and confidence in this unique venture. It is altogether fitting at this point to list some of the recently distributed propagating material which has been sent to arboretums, botanic gardens, and to nurseries here and abroad: *Koelreuteria paniculata fastigiata, Ginkgo biloba pendula, Picea pungens glauca* 'Montgomery,' *Picea mariana Beissneri, Laburnum alpinum pendulum, Acer Schwerinii, Tilia tomentosa erectum, Quercus Robur pendula, Ilex crenata nummularia, Pieris japonica pygmaea, Berberis Thunbergii atropurpurea* 'Golden Ring,' *Fagus sylvestris horizontalis,* and *Cercis canadensis plena.*

At present there are a number of research projects under investigation. College students, employed during the summer months, are carrying out an extensive program on the usefulness of various chemicals in the control of weeds. The use of mulches around the permanent plantings continues, but our attention is focused on the use of polyethylene film sheets covered with a heavy coating of sawdust. This experiment is being tried around the mountain-laurel; if all goes well, it will be adopted for all ericaceous plantings. Unquestionably, dawn redwood *(Metasequoia glyptostroboides)* is not readily adaptable for present-day planting due to its eventual size. We are trying to find a method of dwarfing this tree either by x-raying seeds or cuttings or by grafting on to a suitable dwarfing understock. Tests indicate a bright future for rooting varieties of hornbeam, which were formerly either bud-grafted or grafted. Furthermore, we are confidently predicting that a large percentage of oaks will be rooted under the very favorable plastic method of propagation. There are sound reasons why more dwarf rhododendrons should be consistently used around the home grounds, for they are so versatile. The trend for smaller homes has created the necessity for producing dwarf rhododendron hybrids for landscaping purposes. The present Catawbiense hybrids look out of place, and we are facing this problem by growing one hundred species of rhododendrons to provide a wider selection of color combinations in custom-sized hybrids in the years to come.

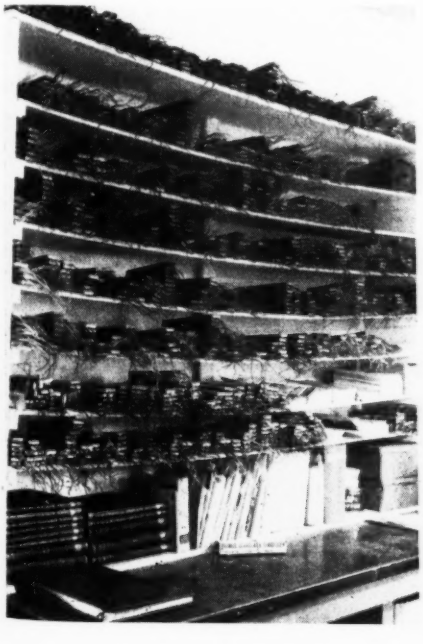
Associated with Holden Arboretum are three camps which operate during the summer, two for boys and one for girls. The programs carried out by these young people are a tangible contribution in terms of work projects for the Arboretum, and in turn provide the campers with a rich and practical experience in association with living plant material which will help them assume their responsibilities in society.

House at Shady Brook, a valuable new addition to the Arboretum.

After a long and full summer season the Arboretum settles down to the quiet loveliness of winter, when it becomes practically uninhabited and there is a more relaxed pace in outside activities. We then begin the many rewarding programs in the greenhouses. On Saturday mornings a class is held for Girl Scouts, with many mothers participating in a course of practical horticulture. There is also a carefully-planned course in plant propagation for members of the Arboretum and this is followed by a class from the Rehabilitation Center of Cleveland. Here individuals, who are the unfortunate victims of fate, gain a new concept of life by working with living plant material. Two of these students now feel confident of success in starting their own small nurseries.

Newspapers and horticultural publications have already told the story of the classes for the Golden Age Center of Cleveland. Two days a week these elderly people are driven to our green-

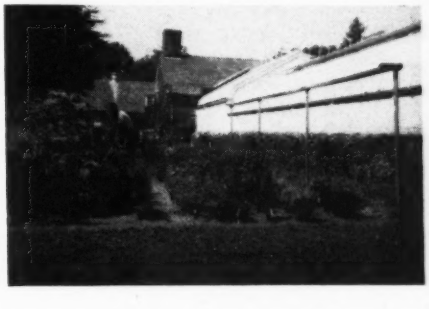
(Continued on page 65)



Left. Backlog of tree and shrub labels made by campers during the summer.

Below. Camp girls bud grafting in the nursery row.

Right. Propagating Department at the Holden Arboretum.



A Gardencraft class gets a start. Children watch Mrs. Weber lay out the demonstration plot.

A Gardencrafter receives some special instruction from Mr. Dowling.

Miss Callaghan shows a Gardencrafter how to firm the soil after seeds have been sown.

CHILDREN'S GARDENCRAFT PROGRAM

By Lillian Weber

TEACHING a first-year children's class is a stimulating experience. Alert minds and agile bodies provide a combination that tests the instructor's energies, abilities and, sometimes, patience. But it can be a truly rewarding field of endeavor, especially when the subject taught is as fundamental as practical gardening.

In 1957 The New York Botanical Garden instituted, as part of its Educational Program directed by the Curator of Education and Horticulturist, a class in Gardencraft for children. It was my privilege to teach this class; as assistants I had the able cooperation of Miss Nancy Callaghan and John Dowling. Actually, this was not the Garden's first recent venture in giving class instruction to children — both in 1956 and 1957 we operated in spring a short course called the Children's Plant Workshop — but the number of boys and girls that attended the Workshop was so large (between six hundred and seven hundred) that student participation proved impracticable; the Workshop is basically a "show how" program—the children's Gardencraft class was strictly a "do-it-yourself" effort by the children, with, of course, some instruction and demonstrations about "how-to-do-it" as well as general supervision to see that work proceeded smoothly and effectively.

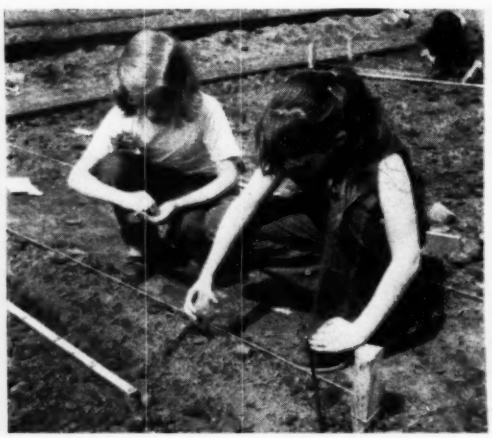
The Gardencraft class was designed to teach children practical gardening on plots of their own, outdoors. We met each Saturday morning during April, May and June, and in July and August on Tuesday and Thursday mornings. Fifty children were enrolled, twenty-one boys and twenty-nine girls. They were recruited almost entirely from New York City, mostly from the Bronx but with a sprinkling of students from Manhattan. The age range was from eight to fourteen years.

Teaching facilities, consisting of an area at the back of our Administration Building and a classroom-toolroom in the basement of the building, were provided. The plot area was fenced and, in preparation for planting, the ground was rototilled, manured, and fertilized. Pipe lines were laid so that water would be available and that proved a crop-saving provision during the extraordinarily dry summer of 1957.

Since this was a new undertaking for us, we thought it would be a good idea first to observe children's gardens at other institutions. Naturally, we turned for help to our sister institution, the Brooklyn Botanic Garden, which has operated such a splendid and well-organized program of this kind for a great many years. Dr. George S. Avery, Director of the Brooklyn Garden, Miss

Transplanting lettuce seedlings.

Partners on the same plot cooperate in sowing seeds.



A necessary but not always popular garden chore — weeding.

Frances M. Miner, Curator of Instruction, and other members of the staff extended themselves far beyond any reasonable "call of duty" to give me all the information they could. To my friends at Brooklyn I am grateful. I went to the Brooklyn Garden regularly during the late winter, spring, and summer both in 1956 and 1957. From those visits I gleaned many ideas — many of which were incorporated in The New York Botanical Garden's more modest children's program.

In July 1957 I accompanied Mrs. Sam Lasker and T. H. Everett to the Montreal Botanical Garden to inspect the splendid facilities there and to learn of the ambitious children's gardening program that is maintained under the able supervision of Henry Teuscher, Curator of the Montreal Botanical Garden, and Marcel Racine in charge of the Children's Gardens. From that visit, too, I came back filled with ideas and ambitions for our New York Botanical Garden program. To Mr. Teuscher and Mr. Racine, I am deeply indebted for the courtesies extended on the occasion of our visit.

Above—Radishes were the first crops harvested by the Gardencrafters.

Upper Right—These girls were proud indeed of the lettuce they harvested.

Lower Right—Harvest time—the reward of earlier labor.

Each plot was shared by two children. The children planted, grew, and harvested a number of crops. They had radishes, lettuce, carrots, beets, onions, beans, broccoli and tomatoes, as well as a row of zinnias and marigolds. Every week after the fifth or sixth one, when the first radishes were pulled (and what joy this first visible evidence of the power of the land to produce brought), the children had something to harvest and take home.

A group of Gardencrafters preparing to take home a morning's harvest.

At each session, before the girls and boys did any work in their own gardens, they were given instruction on a demonstration plot. They were taught step by step. While at work on their own plots, they were given help as they needed it. Miss Callaghan, Mr. Dowling and I circulated constantly to make sure everything went well.

Tools of special small sizes were purchased so that the children could handle them easily. Each set of tools was numbered to correspond with a plot number. The children were made responsible for cleaning and putting away their own tools in racks that were provided in their toolroom.

The children enjoyed the Gardencraft class — there is no doubt about that — they had fun. They also learned a great deal about the miracle of growing things—a revelation, indeed, to city children. They got their fingers in the dirt—and that was good, too—and they learned the virtues of steady work and the need for patience. They experienced success and suffered occasional reverses.

(Continued on page 67)

Because we made a late start in 1957 and because budget-wise we were quite limited, of necessity our facilities did not nearly equal those of Brooklyn or Montreal. Often we had to improvise. But perhaps it was better that way — we learned to crawl before we ran or even before we walked very steadily.

After much thought we decided to make the plots ten by ten feet, and a standard planting plan was adopted.

Children only were allowed on the plots during working time. Interested adults watch from the fence.

CYMBIDIUMS

By **John G. Borin**

A beautiful hybrid cymbidium growing in the Conservatory of The New York Botanical Garden

THE ORCHID that is becoming more and more popular each year is the cymbidium. When cut for home decoration its long graceful racemes, averaging twelve to thirty and more flowers, have excellent keeping qualities, as do the flowers when used in corsages. Whether blooms are cut or left on the plant, the cymbidium is one of the few flowering plants that gives so much satisfaction over such a long period of time—from four to six weeks.

The color range of its flowers includes pink, rose, white, yellow, ivory, bronze, and shades of green. The old varieties, with smaller and brownish green flowers, are losing favor; they have been replaced by many new and better ones.

Just a few of the newer kinds offered today are: *Alexanderi* 'Westonbirt,' broad white sepals and petals, red marked lip; Dorchester 'Stardust,' large white flowers with rose flushing on sepals and lip edges; Glendora 'Ember,' deep dusky rose flowers of large size; Janette 'A.A. McBean,' huge flower of excellent form and substance, in lemon-yellow; and Swallow 'Ambassador,' large flower, greenish ivory shaded rose and large yellow lip marked deep red.

The Korean, Japanese, and Chinese people are especially interested in the smaller and miniature forms and appreciate their grace and beauty. They grow them in artistic oriental containers or bonsai pots.

Most people in this country, however, are interested in the hybrids. These have been produced during the past twenty years or so from species native to Asia, where they grow along the lower slopes of the Himalayan Mountains, and Australia. A few outlying species occur in Africa and New Caledonia. Many are found growing on trees (epiphytes), but in the greenhouse we treat them as soil-inhabitants (terrestrials). They adapt themselves very well to this type of culture and reward us with healthy flowering specimens. Their grasslike foliage is graceful, and they make really attractive pot plants. In parts of Florida and California, cymbidiums are planted outdoors.

Cymbidiums are easy orchids to grow. Anyone who has had experience in growing camellias or azaleas under glass should have no difficulty with them. They require a cool temperature, and like a night temperature between 50° and 55° in winter; on sunny days a rise in temperature of ten to fifteen degrees. A high temperature with a high humid atmosphere is detrimental to them. Growing cymbidiums cool with good air circulation and the right humidity will cause the flowering spikes to develop slowly and sturdily, thus furnishing larger flowers of good color.

The flowering season extends from about November to April—actual flowering dates depend on the varieties. Here at The New York Botanical Garden a few kinds start flowering in November; by February and March the cymbidiums are at the height of their bloom, with many varieties represented.

Some of the varieties need to have their flower spikes staked, as they are by nature arching and semi-arching. Others, upright and sturdy types, do not require any support.

During the summer months the plants may be placed out-of-doors in a slat house or under the partial shade of large trees. It is a good plan to place the pots on a cinder bed or on inverted flower pots, as this allows drainage for the plants during wet weather. If they have to be kept in the greenhouse during the summer, then one should medium-shade the glass or use lath shades and give them all the air possible. With proper care they will develop good pseudo-bulbs.

Cymbidiums do not require as much shade as cattleyas. In the vicinity of New York, a greenhouse that runs east and west will need shade from about the middle of February to October; a house that runs north and south will require shade from March to September. During the winter months the house should not be shaded, as the plants need all the light possible. One can tell by the color of the foliage, if the plants are getting the light best suited to their needs. The leaves should be yellow-green; if they are dark green, it indicates they are suffering from lack of light and are getting soft. Outside roller blinds are far superior to any other method of shading, for they may be left off on cloudy days, or raised in the afternoon when the sun is low. The plants will benefit greatly from the increased light. The house will also be much cooler, as the glass does not get so hot from the sun's rays. However, good results can be obtained by shading with white lead and gasoline.

On sunny days the plants should be syringed or sprayed overhead. This may

be done as often as three, four, or more times a day in the summer, depending on how dry the air is. In winter there may be days when no syringing will be required at all. Also damping-down between pots, on floors, and under benches is necessary during the growing season and when the flower spikes are developing, for cymbidiums require a lot of water. Their roots are always active and should never be allowed to suffer from lack of moisture. The experienced grower can tell if a plant needs water by the condition of the surface of the compost in the pot, the weight by lifting the pot, or by tapping it. Watering in the morning is the best practice, especially in winter, so that any surplus moisture will evaporate from the plants before night. Ailing and newly-repotted plants should be watered sparingly for several weeks. On cloudy days when temperatures are below normal, very little watering should be done.

During the growing season cymbidiums should be fed once a week or every ten days with liquid cow manure, fish emulsion, or a complete fertilizer; the rest of the year they are fed once a month. Plants should not be fed in dry soil; they should be watered first, then given their liquid feeding.

It is time for repotting when the lead growths are at the rim of the pot, and repotting may be done in the spring or right after flowering. When cymbidiums are repotted, they should be placed in pots large enough for three years growth, as the roots do not like to be disturbed. The size of pot also depends on the vigor and size of the plant. Plants that are growing well should be repotted once every two to three years in order to obtain the best results. When potting one should be sure to put plenty of broken crock in the bottom of the pots—this is very important, for cymbidiums must have perfect drainage. Sour and constantly wet soil will seal their doom. The plants should be potted firm to hard, with enough space below the rim of the pot for watering. Newly-potted plants should not be watered often until new roots start to grow, but the air should be kept moist about the leaves and pseudo-bulbs.

A good compost for cymbidiums contains osmunda (duck-egg size) three parts, fibrous loam sod two parts, and dried cow manure one part; to each bushel of this mixture are added one five-inch pot of bonemeal, one six-inch pot of small-sized charcoal, and also some material, such as broken brick, gravel, or broken crock, to help keep the compost open. These ingredients should be moistened and thoroughly mixed before any potting is done.

If one wants to increase stock, he can divide the plants every time they require repotting. For propagation, the leafless back-bulbs (pseudo-bulbs) are very useful. These bulbs are divided, the base of each bulb is placed in sand to one fourth or one third its depth, and the sand is kept lightly moist. The bulbs may be placed under the staging of mature plants until they make new roots. When the roots are about one inch long, the mother bulbs and baby plants may be potted into three-inch or larger pots, depending upon the size of the bulbs, and may be grown along in the same house with the mature plants. The first flower spikes will appear in about three or four years.

Insects are not too bothersome, if the plants are healthy and given the proper care. Scale and thrips can be kept under control by using DDT fifty percent wettable powder. Slugs that eat the blossoms and young succulent flower spikes can be kept in check by a poisonous bait of metaldehyde, arsenic and bran. Spray plants and benches with chlordane, if ants are present.

HOLDEN ARBORETUM (from page 61)

houses by representatives of garden clubs in a new Volkswagen bus donated by Mrs. Warren Corning for this very purpose. While the men folks adapt themselves better as they embark on a new adventure, the women, with their sparkling faces, are filled with curiosity and the determination of school girls. As one elderly woman said, "We are becoming a part of the Holden." The genuine humanitarian approach with these participating groups has brought a number of requests from University schools, garden clubs, and medical centers throughout the states. The Cleveland and Hanna Foundations have revitalized this program by providing an assistant to the horticulturist. Other groups, such as blind and crippled children, will also be made to feel welcome. The garden club volunteers fully enjoy their responsibility in these rewarding programs.

Garden clubs play an important role in the continual development of the Holden Arboretum. Recently the Garden Club of Cleveland donated funds for an initial planting of species roses. This spring the roses were planted amongst the crab-apple collection and are soon to be dedicated in memory of Mrs. B. P. Bole, who for many years shared her love for the Holden Arboretum and was a devoted member of the Garden Club of Cleveland.

Warren H. Corning, Executive Director of the Holden, initiates a diversity of projects to inspire and satisfy today's horticultural public. The growing membership (fourteen hundred) in the Arboretum is an indication of the success of his policy.

While the future of the Arboretum has been adequately provided for through the will of Albert Fairchild Holden, it is at present dependent upon funds raised through memberships and a few substantial gifts from devoted citizens. With their help the purpose and promise of the Holden Arboretum will be fulfilled and will continue to bring cultural enjoyment, through horticulture, to the citizens of the Buckeye State.

OUR COVER ILLUSTRATION

JOHN EVELYN

John Evelyn (1620 - 1706) began writing his famous "Diary" when he toured Flanders, France and Italy as a young man — the "Diary" which he was to keep faithfully for over sixty-five years. He knew and loved plants and devoted himself to their cultivation and improvement — and also to the improvement not only of his own garden but of the gardens of other estate owners. Loudon, in his ENCYCLOPEDIA OF GARDENING wrote: "Evelyn is universally allowed to have been one of the warmest friends to improvement in gardening and planting that has ever appeared . . ."

His SILVA OR A DISCOURSE ON TREES is a ". . . beautiful and enduring memorial of his amusements, occupations and his studies, his private happiness and his public virtues . . ." His KALENDARIUM HORTENSE published in 1664 is copied even today in garden publications.

The beautiful *Narcissus incomparabilis* 'John Evelyn' is presumed to have been named by its originator, W. F. M. Copeland of Southampton, England, in honor of this noted gardener and writer. Mr. Copeland introduced this narcissus at the meeting of the Royal Horticultural Society in 1920, and on March 23 of that year the Society gave it an Award of Merit.

HARDY SHRUBS

By Louis P. Politi

Syringa

HARDY deciduous (leaf-losing) shrubs are of great importance to the gardener and landscaper. They are the backbone of any landscape planting — without shrubs no garden is complete.

In addition to their individual beauty of form and flower, when grouped and arranged together, their masses and textures provide the "furniture" which is used to decorate and enhance the garden. This skeleton of shrubs is the pattern which binds the garden together into a homogenous unit.

Shrubs are also used to divide a garden into areas or rooms which create interest. A favorite spot may be dramatized through the effective use of shrubs. Shrub screens give privacy and protect plantings from the wind. Shrubs are indispensable as backgrounds for flowers or flower borders. Harsh foundation lines may be subdued and softened by properly placed groups of shrubs.

The proper placement and arrangement of shrubs is very important. They must be situated so that they are pleasing to the eye and that they fit naturally into the over-all landscape picture. Natural inequalities in topography can be emphasized or masked by proper selection of material to give variations in height and width.

Growth requirements must be taken into consideration when selecting shrubs for specific sites. A plant which thrives in a moist lowland situation may suffer if planted on a dry bank. Some shrubs do best in full sun, others appreciate a shaded situation.

No matter how carefully shrubs are selected, no matter how pleasantly they are arranged, it is all for naught if they do not receive good care. There is a tendency to feel that hardy shrubs do not require much care, that they will do just as well if allowed to shift for themselves. The results of such short-sighted treatment can be seen on every hand — straggly plants, unpruned, starved, eye-sores rather than assets.

Good soil preparation is the most important factor for growing shrubs successfully. For a bed of shrubs the soil is prepared to a depth of two feet, incorporating into it large quantities of humus. The humus may be in the form of half-rotted manure, leafmold or peat moss, in quantities up to one-third of the total volume. Lime (ten pounds per one hundred square feet of bed), and a complete organic fertilizer (applied according to directions) are beneficial. Lime is never used when preparing soil for rhododendrons and azaleas. For humus use peat moss which will maintain the desired acid level.

If it is not possible to prepare the soil to a depth of two feet, single digging to a depth of one foot will usually give fairly good results.

Transplanting must be done carefully. A good-sized ball of roots is taken with the plant, and it is advisable to wrap the roots in burlap to keep them moist.

If planting in a prepared bed a hole is dug just large enough to accommodate the root ball, the soil is trodden firmly around the roots and plants are thoroughly watered.

If shrubs are planted singly in an unprepared area, a more generous hole must be provided for each shrub; otherwise the procedure is the same.

Shrubs are pruned severely when transplanted — as much as one third of the branches may be removed. This pruning is a thinning process rather than a drastic cutting back of the upper branches.

Shrubs must be pruned regularly to

Left. *Aesculus parviflora*

Below. *Hydrangea quercifolia*

Right. *Myrica pensylvanica*

keep them vigorous, shapely, and free-flowering. Every effort must be made to preserve and enhance the natural habit of growth. Regular pruning eliminates the necessity for drastic cutting back and consists of removing dead wood and unsymmetrical branches, thinning out weak shoots, and heading back long ungainly branches.

Spring flowering shrubs (forsythia, lilac, kerria, etc.) are pruned directly after flowering. Summer flowering shrubs (buddleia, hypericum, etc.) are pruned in late winter or early spring.

After shrub beds have been planted, clean cultivation is practised and a dust mulch maintained around the plants. After several seasons when the bed has become filled with roots all-year mulching is desirable. Mulching materials are peat moss, rotted leaves, hay, straw, buckwheat hulls, decayed manure, and the like.

Watering must not be neglected during dry periods, and after plants are established an annual feeding with a complete fertilizer is of great help.

When groundcovers are used in shrub beds, deep feeding and watering are necessary to get below the level of the roots of the groundcover plants.

Have you a friend who would enjoy the privileges of membership in The New York Botanical Garden? Why not tell him about them, and suggest that he, too, become a member?

- **Reduced rates for study courses, lecture tours and other activities for which the Garden charges a fee.**
- **Share in the annual plant distribution.**
- **Discounts on the purchase of books, bulbs, plants.**
- **Admission to Members' Day Programs and to previews of special exhibits.**
- **Personal conferences with staff members on plant identification, on culture and care of plants.**
- **Use of the library and, under staff guidance, the herbarium.**
- **Free rides on "The Floral Flyer" (tractor train) and free parking at the Garden on weekends and holidays.**

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A member of The New York Botanical Garden also has the satisfaction of contributing to the advancement of the botanical and horticultural sciences.

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THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York 58, N. Y.

EVOLUTION OF GARDENS (from page 50)

1926) it was found that the hybrids formed fertile seeds which grew into a true-breeding race of primroses—something which could be described as a new species produced by hybridization.

What happened to make the sterile hybrid fertile? What could reconcile those different sets of chromosomes with each other? The answer is polyploidy. In the hybrid the entire group of chromosomes, composed of both parental sets, *doubled* (it became tetraploid). There were now *two* sets traceable to parent A, and they could form pairs with each other; and *two* sets traceable to parent B, which could likewise form pairs among themselves. Gametes were formed with the doubled number of chromosomes.

This has happened again and again. A Swedish investigator, Arne Müntzing, observed it in one of his experimental hybrids between two wild species; and the plant thus formed closely resembled a third wild species! This was almost proof that the third species originated by hybridization from the other two. Many species seem to have had such an origin: species of tobacco, of iris, of various grasses, of spider-lily, and others. In 1928 a Russian plant breeder, Karpechenko, succeeded in producing fertile hybrids between radish and cabbage—plants in two different genera of the same family.

In all this talk about chromosomes we must not forget the cytoplasm—the part of the protoplasm that is not nucleus. The zygote gets its cytoplasm at least mostly, if not entirely, from the female gamete; the male gamete contributes little or none. Consequently bodies normally found in the cytoplasm, such as the rudiments of the chloroplasts, are inherited from the female parent only. When this parent is variegated, and all its chloroplasts are not green, the condition may turn up in the offspring; variegation in the male parent may not have the same effect. Our knowledge of cytoplasmic inheritance is still rather vague; there are signs that it may be augmented in the near future.

When we can identify a cause which operates in nature, we can sometimes duplicate it in our laboratories. So the plant breeder has learned to watch for mutations, to combine them by breeding with some knowledge of the way in which characteristics behave in successive generations, and to juggle chromosomes. The gardener has an advantage over "nature" in being able to choose his means of reproduction, to apply hormones to induce rooting, and generally, as Marvel wrote, to cause things "to procreate without a sex." On such methods we depend for much of the profuse variety of our gardens, as well as for the increased yields of our fields and orchards.

GARDENCRAFT (from page 63)

They learned how to cooperate with one another.

Planting seeds and harvesting crops were the most popular chores—weeding perhaps the least enjoyed. Dusting for insect and disease control was done by the children. They loved to get their hand on the spray gun. We saw nothing but clouds of white dust, when they first started using it. The inventive Mr. Dowling put a scarecrow in the garden to keep the crows from picking at the tomatoes. This amused the class.

Generally speaking, the children worked well together on the plots but occasionally they would have a spat, either over one doing more work than the other or over distribution of the harvest. Sometimes their tools were left in the paths, wrong side up, and this had to be corrected—occasionally tools were surreptitiously put away before they were cleaned and this had to be corrected, too. A system of awarding marks and stars for good work proved an incentive.

One rule that proved necessary and invaluable was that adults (parents, and others) were not permitted in the area during class sessions. At the end of the course we had a party and an inspection of the plots to which parents were invited.

This accounts for our first year's effort at children's Gardencraft. I look forward to the 1958 season with pleasure and with the sure belief that our efforts will be successful in providing knowledge and developing character. I hope that at The New York Botanical Garden we may soon develop children's programs as extensive and as successful as those of the Brooklyn Botanic Garden and of the Montreal Bontanical Garden. I have every belief that we can.

A Country Housewife's Garden

By **Gertrude B. Foster**

AMONG MY beloved old books is a curious little one entitled NATURE'S PROGRAM. It is primarily an outline of the birds, animals, and flowers most noticeable in certain months. The year starts with March, which the Indians called "The Wakening, or Crow Moon." I can appreciate this appellation because here in the country the crows, in March, begin to call on the wing as they move from night roosting sites to daytime feeding grounds. During the dark winter mornings they were silent, if indeed they were around at all, but their raucus but most welcome caws wake me now, sometimes before the moon has set.

Other signs of spring's approach can be seen along our wood-lined roads. Sap buckets are out, their hinged lids clattering in the March winds. How much better I like the tall galvanized pails, often two to a large tree, than the newer method of catching the sap in plastic bags. That has such a clinical look, as though the tree were being bled, as one of our southern friends exclaimed when she saw sapping operations for the first time. The age of some of the finest sugar maples seems to suggest that this annual letting of sap which has gone on for hundreds of years does not diminish the trunk's vitality. When one tries making maple syrup or sugar at home and discovers that it takes forty gallons of sap to yield one gallon of syrup, one marvels not so much at the trees as at the sturdy Yankee people who in some places, even in Connecticut, make a large part of their cash income from maple syrup and sugar.

This is not just a pleasant day excursion into the woods, when the sun is warm enough to send the temperature above freezing in the daytime, making the sap rise. Once the buckets are out the sap must be gathered daily. When there is sufficient quantity gathered for boiling, the fire must be stoked continuously and the pan watched for density of the syrup or signs of burning. This round-the-clock vigil may be kept up for weeks if the grove of maples, known as the "sugar bush," is large. Only the wealthy forest owners can afford pipe lines and mechanized equipment for bringing sap to the boiling house from which a sweet steam will issue twenty-four hours a day. Most of the operations in this section are small and therefore laborious.

Everyone who first moves to the sugar maple country wishes to try collecting a little sap and boiling it down. There are lots of stories about, of wallpaper, newly placed on a redecorated old house, slowly peeling off the kitchen walls as the steam from the syrup kettle filled the room for the number of hours necessary to get a bit of syrup. I have never had the opportunity of being at a sugar house at the moment of sugaring-off so that I could taste "sugar on snow." But I have promised my children to try it this year, even if I have to buy the syrup from Vermont.

There is always a likelihood of snow in March—that is the time we get some of our fluffiest and deepest piles of it. It is the kind I like to sprinkle on the rug to bring up the color as it is swept off. There seems to be a special airiness about March snow that is responsible for old wive's tales connected with it. One, handed down from an Indian laundress in my husband's family, was the notion that the first snow in March was good for sore eyes.

You can imagine my delight when I read in a seventeenth century Stillroom book the following elaboration on that recipe:

AN EYE WATER

"Take a new earthen vessel never used and so many gallons as it will hold so many ounces of white copperice in fine powder and when snow is on the ground fresh gather it very clean and put some snow in the pot and then some of the powder, do so until all the copperice powder be spent and the vessel full. Then cover it with a clean cloth and set it in a cellar till the snow is all melted off the ground, then strain it and keep it for use in bottles . . . In short it is good for all distempers in ye eyes, for old sores in legs if bathed warme with, but to drop in ye eyes it must be cold."

The same North Carolina mountain friend, who was shocked at the widespread tapping of trees in New England, used to go out in the spring and tap a large wild grape vine to collect the sap for a hair rinse. She said her grandmother always told her that it makes the tresses soft and shining after the long winter. Since learning of this I have come across mention of the juice of the wild grape vine as a remedy in old England.

March and April are seed sowing times with us. Shirley poppies, love-in-a-mist, larkspur, and other hardy annual flower seeds are sprinkled on the melting snows where the plants are desired in the garden. Chervil, perilla and ambrosia can be added to the herb plantings this way.

After working for a little time in a friend's greenhouse last winter, I have changed my way of starting seeds indoors. Instead of screened sphagnum moss over soil, I am using vermiculite only for seed sowing. Burnet comes up in two days; basils, which have to be covered with the stuff very lightly, sprout in a week; and the other slower-growing seedlings will do almost as well. If a pot of seedlings needs pricking-off, and they will quite a bit sooner than in soil, the undisturbed portion of the pot can be left to grow on and many more seeds may germinate later. As soon as sprouts appear it is necessary to water with a mild solution of liquid plant food. In some cases, the dose is repeated every four days to keep the little plants from marking time.

The germination is so splendid in this medium that a four-inch pot of seedlings will fill several flats with young plants. In the greenhouse, I moved petunias, verbenas, and alyssum when they were so tiny that it was hard to handle them without tweezers.

But the vermiculite fell away from the root hairs so nicely that not one seedling was injured by being lifted, though some were lost in the holes made for them in the flat.

It is a mistake to try to use vermiculite over again as it will get slimy and grow green algae after being wet for some time. There is a new preparation of the same type which is white and looks like sand, called "grains of pearl" or some such name in the trade. It seems to be a better rooting medium for cuttings than plain vermiculite.

OUTDOOR CHRYSANTHEMUMS **(from page 59)**

and lower leaves and travel quickly up the plant.

INSECTS, some of them, depending on living vegetation for their sustenance, carry diseases from plant to plant. By sucking the juices from beneath a tight bud, insects can deform the flower or even cause total failure.

FROST AND FREEZING: under normal conditions, frost and sometimes freezing weather can be expected in October. Frost can burn the flower petal tips and freezing can ruin the flowers. However, in our area, freezing so seldom occurs that growing mums is worth the gamble.

GROWING ORCHIDS **(from page 41)**

low for cymbidium bloom spikes.

(4) Cypripediums of both the warm and cool types have bloomed, but they do not perform consistently year after year.

(5) Small seedling cattleyas can not take the violent humidity fluctuations and grow too slowly. I have excellent success with mature cattleyas, provided I give them my best spots near the glass in the south windows.

(6) Vandas are in general too tall. Light is insufficient and humidity too low for long-run success with this genus.

Following is a list of choice botanicals that have done well under the conditions in my windows:

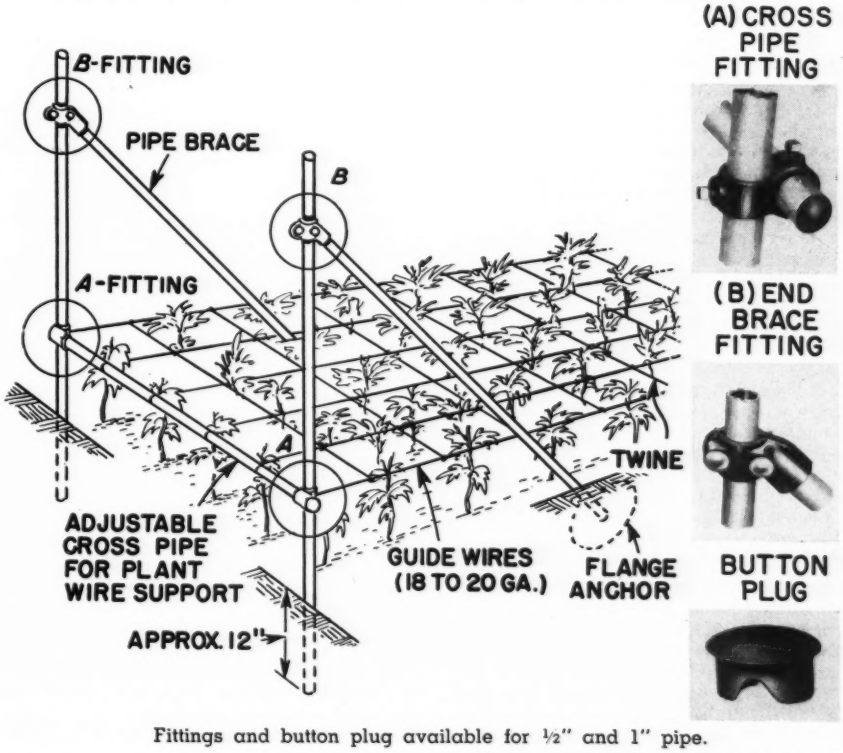
Brassavola cucullata
" *nodosa*
Brassia verrucosa
Calanthe (hybrids)
" *Sieboldii*
Catasetum macrocarpum
" *saccatum*
Chysis bractescens
Cyrtopodium punctatum
Diacrium bicornutum
Epidendrum alatum
" *aromaticum*
" *atropurpureum*
" *ciliare*
" *cochleatum*
" *falcatum*
" Mariae
" *oncidioides*
" *prismatocarpum*
" *radiatum*
" *Stamfordianum*
" *tampense* var. *alba*
Laelia albida
" *autumnalis*
" *Gouldiana*
" *majalis*
Laeliopsis domingensis
Lycaste aromatica
" *cruenta*
" *Deppei*
" *Skinneri*
Maxillaria picta
Miltonia candida
Odontoglossum bictoniense
" *citrosmum*
" *grande*
" *pulchellum*
Oncidium ampliatum
" *carthaginense*
" *Cavendishianum*
" *flexuosum*
" *goldiana*
" *hastatum* (or *maculatum*)
" *kaiulanie*
" *Lanceanum*
" *leucochilum*
" *luridum*
" *macranthum*
" *microchilum*
" *oblongatum*
" *ornithorhynchum*
" *splendidum*
" *tigrinum*
" *varicosum* var. *Rogersii*
Sobralia macrantha var. *nana*
Trichopilia suavis
LOVELY MINIATURES:
Angraecum falcatum
Dendrobium Lodigessi
Laelia Lundii
Oncidum pulchellum
" *triquetrum*
" *variegatum*

Third Eastern Orchid Congress—New York City. On the first day, May 2, 1958, these greenhouses will be open from 10 a.m.-4 p.m. to those attending the Third Eastern Orchid Congress: New Jersey — H. Patterson & Sons, Bergenfield; Floriculture Greenhouses, Rutgers University, New Brunswick; Mr. & Mrs. A. P. Hewlitt, Berkeley Heights; Joseph A. Manda & Son, West Orange; Long Island — Brookville Orchids, Westbury; Cali Orchids and Kieselwelter Orchid Gardens, Albertson; Westchester County—Rodney Wilcox Jones, New Rochelle; George Baldwin Co., Mamaroneck; New York City — Brooklyn Botanic Garden and The New York Botanical Garden.

On the second day, in the morning, afternoon and evening sessions to be held at the American Museum of Natural History, talks will be given by Dr. James A. de Tomasi on "Fascination of Botanical Orchids," by William Kirch on "Orchid Culture in Hawaii," by Dr. O. Wesley Davidson on "Progressive Methods in Orchid Culture," by Mrs. L. D. Barry on "Orchid Corsages and Arrangements," by Dr. Herman Sweet on "Miltonias for the Amateur" and by Mrs. Lewis C. Vaughan on "How the Vaughan's Grow Orchids."

The third day, May 4, will be devoted to a tour of Floral Gardens, Inc., Westwood, N. J.; Eagleridge Greenhouses and Plant Laboratory, West Orange, N. J. and Lager & Hurrell, Summit, N. J. Don Richardson, Manager of Eagleridge is President of the Third Eastern Orchid Congress.

Illustration 2
A pipe arrangement with an adjustable cross-pipe to hold plant wire support.



Fittings and button plug available for ½" and 1" pipe.
Courtesy Lord & Burnham, Irvington, N. Y.

BOOK REVIEWS

EXOTICA. PICTORIAL CYCLOPEDIA OF INDOOR PLANTS. Alfred Byrd Graf. 643 pages, 4,000 illustrations; indexed. Julius Roehrs Co., Rutherford, N. J. 1957. $17.50, plus 50¢ postage.

Perhaps only those who have authored books of substantial size and content can fully appreciate the tremendous job that A B. Graf has accomplished in producing EXOTICA. Here, for the first time, are assembled some four thousand reproductions of photographs of plants presently cultivated in American homes, offices, stores, greenhouses and, where climatic conditions permit, out-of-doors. EXOTICA is primarily an encyclopedia of illustrations, but it is much more than that, for its pictorial content is well larded with excellent, informative and useful text which, although neither long nor word-wasteful, is pertinent and precise to a degree that only an author long experienced in the field with which he deals and possessing a passion for meticulous accuracy can approach.

I have been privileged to observe A. B. Graf work on EXOTICA and its more modest predecessors. Frequent visits by him to the Library of The New York Botanical Garden and the many consultations he has had with staff members of the Garden have, I like to think, played no small part in making EXOTICA the fine work it is (Mr. Graf makes gracious acknowledgment of this in his foreword); but while he has occasionally used others as a cane to enable him to walk better, he has never regarded them as crutches to rest upon — EXOTICA is the concept of A. B. Graf and a monument to his tireless energy and ability. For him the thank you's of all true plantsmen.

Almost all the photographs reproduced are original, most of them are splendid. In a very few cases, as for instance, the picture of *Haberlea Ferdinandi-Coburgii* and that of *Mentha Requienii*, the reproductions are not good or the pictures do not adequately portray the characters of the species—but to mention these few among so many excellent ones approaches quibbling, especially as the auther explains that such inclusions were made to obtain as wide a representation of plant families and genera as are practicable.

EXOTICA contains a wealth of sound information on the care and culture of indoor plants, pictured ideas for arrangements in dish gardens, terrariums and planters, illustrations of methods of propagating plants, most excellent line drawings explaining descriptive botanical terms (a modest L.E.K. in the lower right hand corners of these plates bear testimony to the fact that Lucille E. Kopp, a graduate student at The New York Botanical Garden, is responsible for these), an extensive dictionary of common names of house plants, brief descriptions (illustrated) of botanical families, descriptions of the plants illustrated and a fine section on Plant Geography.

To have available this superbly illustrated encyclopedia of such a large number of exotic plants presently cultivated in America provides gardeners and horticulturists with a ready reference tool that will save them vast amounts of time and energy, will make identification of plants immensely easier and more certain, and will help to standardize plant nomenclature as used in horticulture.

EXOTICA will undoubtedly do much to stimulate interest in plants both old and new. No one who has any serious interest in tender exotics can afford to be without this fine book. It should certainly find a place in every public library, because interest in house plants is nation-wide, and interest in greenhouse plants and in the use of exotics outdoors in sections of the country where climate permits is growing.

T. H. EVERETT

PLANTS FOR EXTRA-TROPICAL REGIONS. Peter Riedel. 763 pages, quarto, cloth. Typewritten, reproduced by photo offset. Limited to 105 copies, published by the California Arboretum Foundation, 1957. Privately distributed on loan basis.

Great treasure for serious growers of ornamentals in southern California, Florida, and other warm areas lies within the covers of this volume, the fifty-year accumulation of plant notes by one of the great plantsmen of our time. Peter Riedel did more than any other one person to establish the Australian and South African plants that now distinguish the southern California landscape. His "California Acclimatizing Association" was able at one time to offer ten thousand kinds of exotics. He kept notes on them all, he searched literature and plant catalogs from all the world, and before he died (1954) at age eighty-one he put most of these gleanings in order for publication.

I climbed all over the hills of Santa Barbara with Peter Riedel, went over his voluminous manuscript with him, doubted (with him!) it would ever be possible to put these valuable notes in printed form where other researchers could utilize them, encouraged him to keep on. Now ways and means to publish this gigantic work have been devised through the efforts of the Los Angeles State & County Arboretum, Arcadia, Calif., and the world is enriched by the product. Unfortunately the type is small (four typewritten pages reproduced on each book page) but I read two hours with a magnifying glass last night before I could even think about going to sleep. What an intellectual giant was this man Riedel!

EDWIN A. MENNINGER
Stuart, Florida

PLANT DOCTORING IS FUN. Cynthia Westcott. 280 pages, illustrations, index. D. Van Nostrand Co., Princeton, N. J. 1957. $4.50

This is a book which needed to be written. It follows the pattern of such interesting books as Heiser's THE DOCTOR'S ODYSSEY and Fairchild's THE WORLD WAS MY GARDEN. It is the first book to give an insight into a new profession, and it shows that all is not "beer and skittles" in being a "Plant Doctor." Just the prospect of following Cynthia Westcott's footsteps, as she rushes from the Atlantic to the Pacific Coast with stops in between at the Gulf States or the northern tier, makes one exhausted. Yet she has not only to get acquainted as fast as possible with the local conditions and pests prevalent there, but also to give a lecture to garden club members who have undoubtedly had long experience with their local problems. It takes a wide field of knowledge and courage and, above all, stamina to carry on such a rigorous program as is so vividly portrayed by the author.

Dr. Westcott has written five other books, and in this one she gives a detailed picture of how the information for them was laboriously garnered. Then we are taken behind the scenes, yes, even into her kitchen, to learn that it is far from easy to write a book. One has to be dedicated, or else a self-disciplined New Englander, to accomplish so much.

So, to anyone who wishes to become a "Plant Doctor," this book will certainly be an eye-opener and a guide.

IRENE VAN DE WATER
New Paltz, N .Y.

GREENHOUSE GARDENING AROUND THE YEAR. Marion Dulles. 195 pages, illustrated, indexed. Macmillan, New York. 1956. $3.75

This delightful small book is a pleasure to read—for advanced greenhouse gardeners, beginners, or anyone just dreaming of a future under-glass garden. Stroll leisurely at Marion Dulles' elbow as she snips off a faded leaf, plucks a flower, sniffs a faint perfume. Here is a painless way to absorb cultural information month by month. How do you propagate plants, how coordinate light, heat and temperature, when do you spray, water, repot? It's all there in small, easily swallowed doses punctuated by excursions to nurseries or visits to greenhouses and gardening friends.

To help you have real garden enjoyment under glass, Mrs. Dulles shows you her own benches transformed into flower borders equal to any grown outdoors. This is a new approach — one that will appeal especially to home gardeners.

Handy appendices include plant lists of annuals, vines, perennials, bulbs, Christmas plants; sources of seeds and plants; recipes for potting mixtures; and a helpful glossary.

RUTH MARIE PETERS
Indoor Garden Editor
Popular Gardening

EXPLORING WITH YOUR MICROSCOPE. Julian D. Corrington. 229 pages, illustrated, indexed. McGraw-Hill Book Co., New York. 1957. $4.95

There are certain experiences and there is a basic knowledge that should be the universal equipment of all cultured persons, irrespective of professional career or individual scholastic inclination. No less than an appreciation of astronomy and Shakespeare, some fundamental understanding of the microscope is precisely such a requisite equipment or mental investiture. Therefore, it is almost a moral obligation that the life of every young person some day be high-lighted by the gift of a microscope. Naturally, it would be wise to accompany the instrument with a manual that instructs in its proper use.

Corrington's EXPLORING WITH YOUR MICROSCOPE seems to the reviewer a very excellent primer for the young microscopist —and for the older fellow, too, for it is written in an adult style. Generously illustrated by photos and drawings, it is lucid on technique, embedding, staining and mounting, on the mechanics and care of many models of microscopes. It is fact-full and touches a seemingly infinite variety of subjects in microscopy. It suggests varied and curious articles for examination, protozoa, erythrocytes, oölitic limestone, crenated corpuscles, mayonnaise emulsion, insect antennae, the labrum of grasshopper. It lures one to explore the infusorial pandemonium and to see the exquisite design in crystals and diatoms. It does not omit fields

removed from biology; such as the use of the microscope in the study of fabrics, crime detection, metallography—on p. 132 there is a photo of a magnified and etched section of brass that looks like a cubist's art. The author suggests many simple ingenious tricks and expediencies, such as, contriving centering guides for slides, placing pieces of marble in a balsam bottle to keep the liquid neutral, using rouge as a readily available form of carmine for tracing ingestion in paramecium.

There are lists of references in this manual for those that wish to go further, addresses of supply houses and a good handy index. The format is designed for convenience; there are guide-headings or leaders, and there is use of italics and bold face fonts. Also, the broad blank margins on its pages are quite convenient, as they can serve for marginal reminders and notes, in keeping with what the book is essentially—a simple, clear and concise, richly informative, general introductory practical manual on the microscope.

JOSEPH MONACHINO

THE LIVING MUSEUM. Alice Millard Stowell. 88 pages. Vantage Press, New York. 1956. $2.50

This book was written for the very definite purpose of helping a community plan and develop a museum. Hence its appeal is limited. But for any group interested in forming such an institution, THE LIVING MUSEUM is filled with helpful suggestions. These include how to coordinate the museum with the interests of the people it serves, how to attract and keep the interest of children, how to present seasonal displays and how to gather material. The author points out the many problems that beset a new museum but, lest the reader harbor a touch of discouragement, she tactfully explains how they may be solved.

Mrs. Stowell, the author, has had years of experience in museum work. That she is also well versed in travel, history, and the arts is apparent in every phase of her book. Each paragraph bears concentrated thought and only by such concentration can the value of the book be appreciated. Her ideal is a small general museum which, through its cultural interests, will serve as a center for both young and old. The book is less than a hundred pages but it takes time to absorb the subject matter. There are no illustrations in the form of drawings or photographs, but one receives a sense of illustration from the author's descriptive episodes.

ELIZABETH ANN PULLAR
New York, N. Y.

AMERICA'S NATURAL RESOURCES. Charles H. Callison. 211 pages, indexed. Ronald Press, New York. 1957. $3.75

According to scientific estimates, when Columbus made his history-making landfall this side of the Atlantic, there were, in North America, sixty million bison, a million moose, ten million elk, two million wolves, four hundred million beaver, forty million antelope and five billion passenger pigeons! The accuracy of these "educated guesses," as they have been dubbed, will never be known, but even if they are cut in half they are still impressive, for today the bison, after having approached extinction, number only some twenty-five thousand animals, mostly in preserves, parks and zoos; the other mammals are greatly reduced in numbers; and, most impressive, the passenger pigeons are extinct; the last of billions of them died in the Cincinnati zoo in 1914. In addition, five species of mammals and fourteen other species and subspecies of birds have been extirpated, and oblivion has been nearly bestowed on twenty-four other kinds of mammals and on thirty-three species of birds. Such has been the fate of American wildlife over three centuries since the advent of white man into the New World.

With regard to America's primeval forest resources, the cream-of-the-crop of white pines was early removed from New England, first to furnish masts for ships in the King's navy of the seventeenth and eighteenth centuries, then to build homes for the thriving colonists and their succeeding independent nationals. Later the forests of New York, then of Pennsylvania, were depleted, followed by those of the northern Central States and of the Southern States. Today the great timber operations are in the Northwest, America's last stand of virgin forests.

Such depletion of America's natural resources has been the result not only of man's wasteful direct utilization and wanton destruction in making room for his extensive industrial expansion; it has come about also through fire, destruction by disease and insects, and, in the case of wildlife, through the removal of natural breeding habitats.

As early as 1791, when New York State enacted a law to protect wildlife, it was realized by one small group of citizens that such destruction of natural resources could not continue unabated without dire consequences. Since then, as a result of the perseverence and dedication of farsighted individuals, not only have more and more laws been enacted in the same direction but also education on an advanced scale in forestry colleges and in schools of conservation has been promoted to train personnel in the propagation, perpetuation and proper utilization of these resources. Many national and regional, non-profit and non-political organizations have been formed to sponsor this work, for it is only through concerted effort that success can be and has been accomplished. Forty of those associations are today combined in the Natural Resources Council of America, and it was under the sponsorship of this Council that the book considered here was assembled from the writings of a dozen authors.

In this volume historical aspects and protective measures are discussed, not only with respect to wildlife and forest resources but also in regard to soil conservation, water, grasslands, fish and wilderness as parts of our national heritage.

EDMUND H. FULLING

A CONTRIBUTION TO THE HERITAGE OF EVERY AMERICAN, THE CONSERVATION ACTIVITIES OF JOHN D. ROCKEFELLER, JR. Text by Nancy Newhall, prologue by Fairfield Osborn, epilogue by Horace Marden Albright. 170 pages, illustrated in color and black and white. Alfred A. Knopf, New York. 1957. $13.50

The slow and extremely difficult acquisition of the lands composing the Grand Teton National Park is an excellent case history of the almost unbelievable achievement represented by our national parks. Bitter local antipathy and a Senate investigation were only two of the agonizingly ponderous obstacles to the enlargement of the Tetons to include the Jackson Hole Basin. John D. Rockefeller, Jr., was the patient and unseen figure behind this expansion. The circumstances were such that, perhaps, it could have been done only by private philanthropy. The Tetons is only one of the fourteen major projects described in this elaborate and rather expensive volume.

The scope of Rockefeller's achievement is given primarily in pictures. In addition to major parts of eight national parks, it includes three "places near home," three museums in parks, Colonial Williamsburg, and a number of smaller areas. The scenery and some of the history of them is indicated by the photographs, some in color, while a brief text describes the conditions under which preservation was stimulated, and gives various statistics including the price. The reasons for Mr. Rockefeller's interest are stated. It is a handsome, gift-type summation of the extraordinary debt of the public to one man and a eulogy of that man. In the prologue, Fairfield Osborn says of him, "Vision alone was not enough. Wealth alone was insufficient. Concept of the plan as a whole, arduous attention to detail and even passion for perfection, feeling for color and beauty, respect for working associates, talent for administration, patience and, lastly, tolerance of criticism and even of misunderstanding of purpose—all these qualities were brought into play, for all were essential to the fulfillment of the early vision."

Rockefeller stepped in and did those things that the federal government could not or was too slow to do. The reservation of all of our twenty-nine national parks has from the first been a race against time, against the inevitable "development" and commercialization. Relatively few men have led the general awareness toward the idea of preservation. This volume will aid the historian in placing Rockefeller in a proper place in the extraordinary movement for conservation, which contrasts so starkly with the grim rush to exploit which has characterized the settlement of the continent.

In the Great Smokey Mountains National Park alone—for which five million dollars of the price came from the Rockefellers—we have a botanical reserve of unique dimension. Its scientific value will not be recognized fully for years to come, and is certain to increase as our population grows and its resource requirements force a pattern of productive conformity over all remaining landscapes. Whatever cynics may claim philanthropic motives to be, or whatever evolution of our social and political theory prevents the future accumulation of such wealth in one family, the value of these reservations of native America cannot be underestimated.

By way of criticism, the opinion may be offered that the book does not show much imagination in its layout. Many of its photographs are merely "record" shots, presumably to give historical depth. But the text does not reveal just where these particular projects of Rockefeller's fit into the greater national park system, or into the international movement for preservation. At a time when the most ominous threat to the national park system is that of being swallowed up by "outdoor recreation," we are reminded in both Prologue and Epilogue of the millions of people using the parks—as though their principal purpose were to become the "playgrounds" for mil-

lions. One is left wondering whether this important distinction between the natural area and the recreational area has been thought out by the authors, or even by Mr. Rockefeller.

PAUL SHEPARD, JR.
Knox College
Galesburg, Ill.

BOTANY. AN INTRODUCTION TO PLANT SCIENCE. Wilfred W. Robbins, T. Elliott Weier, C. Ralph Stocking. 578 pages, illustrated, indexed. John Wiley & Sons, New York. Second ed. 1957. $6.95

For the second edition in seven years of this textbook of elementary college botany, a new more legible type style has been adopted and the text has been increased by ninety-eight pages. By segregation and expansion, three new chapters on physiology have been added; a fourth additional chapter has resulted from division and augmenting of the original single chapter on gymnosperms and angiosperms. The desirability of the segregation of the physiological discussion from the morphological chapters depends on the teacher and course emphasis. A further addition to the new edition is a glossary. Intercalated also is added information on such diverse topics as wood anatomy and several prominent angiosperm families.

For a subsequent edition, it is suggested that the information on botanic gardens and herbaria be up-dated; this edition has repeated the source material size (forty acres) misprint for The New York Botanical Garden and both the library and herbaria have grown in the last twenty years. Certainly however, Robbins, Weier, and Stocking have produced one of the most attractive and desirable of the numerous botany textbooks.

J. J. WURDACK

BIOGEOGRAPHY. AN ECOLOGICAL PERSPECTIVE. Pierre Dansereau. 394 pages, illustrated, indexed. Ronald Press, New York. 1957. $7.50

This geography book doesn't tell you anything about the vegetation of Burma, nor can you refer to it to discover such details as the pattern of distribution of the American elm and the various members of its family. It is not a documentation of what plants grow where nor what communities of plants or vegetation types occur in various places. Rather, it establishes a background for an understanding of why plants occur where they do, how plant families come to be spread about the world in the ways we find them; and it goes into considerable detail in explanation of plant communities, their relations to each other, and the patterns they present. Dr. Dansereau calls it "an ecological perspective." Its geographical scope is cosmopolitan, but the most minute type of situations are given a share of consideration too. On the one hand the world formation-classes of vegetation and the floristic provinces of the world are discussed, while at the other extreme the ultimate subdivision of the forest association, such as moss colonies, receive mention.

The book is organized according to what Dr. Dansereau speaks of as levels of integration. These are 1) historical, 2) bioclimatological, 3) synecological (ecology of associations of organisms), 4) autecological (ecology of individuals), and 5) industrial (man's influence on organisms individually as species or collectively as communities).

The book is profusely illustrated with what Dr. Dansereau's students refer to as "pierrograms." These are ingenious, graphic diagrams illustrative of vegetation and ecological relationships. They characterize much of Pierre Dansereau's scientific publications.

The title — BIOGEOGRAPHY — implies that the book is inclusive of both plants and animals. Animals are brought in more or less incidentally here and there, much in the way that zoologists writing textbooks of biology include a little botany. This book is really a contribution in the field of botany written by an eminent botanist—America's most cosmopolitan plant ecologist.

The book makes interesting reading, because it does bring together many of the fascinating ideas attempting explanation of why we find plants and plant associations growing where they do.

MURRAY F. BUELL
Dept. of Botany
Rutgers University
New Brunswick, N. J.

THE FAUNAL CONNECTIONS BETWEEN EUROPE AND NORTH AMERICA. Carl H. Lindroth. 344 pages, illustrated, indexed. John Wiley & Sons, New York. 1957. (Printed in Sweden.) $15.00

"The animal species common to Europe and North America are numerous. If conditions among the groups here treated in Chapter I ... are regarded as representative ... the actual number of Eur-American non-marine animal species amounts to more than 5,000 ..." From this the author has developed a highly interesting study of the common and related species of animals (with plant topics sometimes discussed, also!) found on both of these great land masses.

The author has drawn freely from his knowledge of the *Carabid* beetles in helping to explain possible means of transportation across the North Atlantic, in both directions, of species now found in the New and Old Worlds. The thesis most developed, and against which there seems little argument, is that of passage from Europe to Newfoundland and surrounding New World areas of terrestrial animals in ballast of the early trading ships. To survive this transport the author states that the animal should: live on ground; have no special moisture requirements; prefer open ground; not be dependent on special foods; be flightless; and reproduce parthenogenetically.

Other ideas are investigated — and resolved — including fossil evidence, present distribution of circumpolar animals, and the well-known theory of the Transatlantic land connection.

An excellent bibliography for each chapter offers further references for the interested, and a separate index for both plants and animals discussed is provided. A list is given in Chapter I of the land and freshwater animals known, by record, to be found on both continents, breeding there, and not purposely taken across by man, in either direction. The distributional data given in this list will certainly prove valuable to those concerned primarily with problems in animal geography. Also to be found in the prefatory statement to each group included in the list are references to the most recent sources of information by students of the group. Specific examples cited in the body of the text are often, although not often enough, accompanied by a distribution map and a plate illustrating the animal under consideration.

Negatively, it may be repeated that more plates would certainly seem justified. Typographical errors, while not abundant, are noticeable now and again.

All in all, the student of zoogeography will find in this book a welcomed addition to source material on this subject.

WILLIAM M. KEITH, JR.

GENSHO NIHON SHOKUBUTSU ZUKAN. I. COLOURED ILLUSTRATIONS OF HERBACEOUS PLANTS OF JAPAN (SYMPETALAE). Siro Kitamura, Gen Murata, and Hasaru Hori. 297 pages, illustrated. Published from Hoikusha, 20, Itchome, Uchi-Kyuhoji-machi, Higashiku, Osaka, Japan. 1957.

This is a thoroughly modern popular book, the first of a series aimed to provide the general public with a means of identification of the indigenous species of Japan. The main feature of this work is its colored illustrations, most of the five hundred eighty-eight species dealt with being shown. These are supplemented in many cases by analytical line drawings. The text, consisting of keys, descriptions and records of distribution, is in Japanese, the Latin names being used only as headings for the descriptions. English, French and German names are recorded for species of wide distribution. The arrangement of families is by no means standard, the first being the Compositae, the last the Diapensiaceae. Following the main part of the book are short chapters on collecting and storing herbarium specimens and on phytogeography. It closes with indexes of Latin, European, and Japanese names.

For general popular use this work is of considerable value in Japan. The well-printed colored plates are rather crowded, a condition doubtless due to the dictates of economy and the desire to show as many species in color as possible. The book is excellently printed and bound with a well prepared cover and jacket and with other features making it attractive to the Japanese public which appreciates good modern books.

EGBERT H. WALKER, *Associate Curator*
Division of Phanerogams
Smithsonian Institution

THE LIFE AND DEATH OF CELLS. Joseph G. Hoffman. 301 pages, indexed. Doubleday & Co., Garden City, N. Y. 1957. $4.50

What is life and death? An answer to this question is attempted by a bio-physicist for the layman. Utilizing the generalizations of modern biology and specific knowledge of the behavior of cells, life's natural units of structure and function, he draws a lucid picture of the living cell in its varied activities. The picture of necessity at times becomes rather technical, and the layman without some training in the biological sciences may find it difficult reading in places. However, the fascinating details which he includes makes the book more interesting and useful to those with more training in biology.

Dr. Hoffman presents the cell in its setting in the universe along with some of the factors that may affect it during its life. Particular emphasis is given to radiation. He then considers the cell in relation to its neighbors in the tissues of the body. Next he considers the movements of cells in which he brings to the reader some of the contributions of modern biophysical and biochemical research in this field. Organi-

(Continued on page 76)

NEWS, NOTES and COMMENTS

Dr. Robbins Has Retired

As previously announced in these columns, Dr. William J. Robbins retired on December 31, 1957, as Director of The New York Botanical Garden.

During the almost twenty years that Dr. Robbins was Director, many physical improvements were made at the Garden. Roads and bridges were built, old buildings restored and new buildings erected; the Conservatory Range underwent major renovation, the show space being tripled; the renovation of the sixty-year-old Museum and Administration Building got under way —and is still continuing. The plantings of The New York Botanical Garden were increased twenty-five percent—by the addition of the azalea and Dexter hybrid rhododendron plantings, the Havemeyer lilacs, the Montgomery Conifer Collection.

The number of bound volumes in the Library rose from 45, 916 in 1938 to 62,859 in 1957; in the same period, the number of specimens in the Herbarium grew from 1,887,709 to 2,526,214. Plant exploration was carried on extensively in northern South America and in different areas of the North American continent, adding much to the knowledge of plant life in these regions; surveys of and findings from these numerous expeditions were recorded in the Garden's own publications and in other scientific journals—some two thousand papers prepared by staff members appeared in botanical and horticultural periodicals. THE NEW BRITTON AND BROWN ILLUSTRATED FLORA OF THE NORTHEASTERN UNITED STATES AND ADJACENT CANADA, three volumes, by H. A. Gleason and collaborators, was published in 1953; and staff members engaged in the preparation of floras on the Guayana Highland, the Pacific Northwest, California, and the Great Basin.

Public education, public relations and service functions were greatly extended; a Downtown Office was established, and the Volunteer Associates organized.

As a plant physiologist, not a taxonomist as his predecessors had been, Dr. Robbins has been primarily interested in how a plant grows, how it behaves. During his directorship of the Garden, he studied and conducted scientific investigations in various aspects of plant physiology and plant biochemistry, especially in growth-promoting and growth-prohibiting substances and in plant nutrition, for which he has become internationally famous. He was the first to demonstrate that plants use the vitamins they make. Dr. Robbins has also been interested in the study of plant tumors and abnormal growth and in the tissue culture of higher plants. This research was carried out first in the old laboratory in the Museum and Administration Building, and since October 1956 in the modern, one-million dollar Research-Laboratory.

Under Dr. Robbins' directorship, the Garden's research program was greatly expanded. The National Foundation for Infantile Paralysis granted $250,000 for a basic study of antibiotic substances, and Garden researchers isolated five substances in pure crystalline form. None proved useful in treating polio, but one antibiotic sold under the trade name of "Fumagillin" is used in the treatment of amoebic dysentery. Fundamental information on the nutrition of micro-organisms was published by the Garden, which also made the first report on synergism between antibiotics.

One of the studies in which Dr. Robbins has been interested for some years — the morphological and physiological changes which occur as a plant progresses from seedling to adult, and the difference in the form of a plant developed from a leader and that developed from a side branch cutting—took him abroad the summer of 1956. He visited gardens, nurseries, and botanical institutions in England, Scotland, Holland, Belgium and France to learn firsthand from gardeners, nurserymen, and scientists who had amassed considerable information on these matters through the years.

As Director of The New York Botanical Garden, Dr. Robbins traveled extensively in this country and abroad, attending scientific conferences, visiting botanic gardens and other gardens, addressing meetings and symposiums. To cite a few instances — he was one of the group of six scientists sent on a mission to Japan in 1947 to study the status of scientific research in that country and to advise General MacArthur on its organization; he was a delegate from the National Academy—National Research Council to the Seventh Pakistan Science Conference in January 1955; and he delivered a paper at the Colloque International in Paris, September 1956.

Some of the Editor's memorable conferences with Dr. Robbins occurred on his return from these trips, during which he gave her a resume of what he had seen, done and heard—resulting in such interesting contributions to The Garden Journal as "Random Notes on a Visit to West Pakistan" (May-June 1955) and a "Report on the Colloque International" (May-June 1957).

The Editor is deeply appreciative of and grateful to Dr. Robbins for the personal interest he took in The Garden Journal, not only in contributing to its pages himself, but in suggesting and in helping to obtain notable contributions—for example: "Long Life for Wood" by Dr. Carl Hartley, "A New Look at the Food Problem" by Dr. H. A. Spoehr, "Prints at Reef Point Gardens" by Beatrix Farrand, and "Old Tomes and Green Things Growing" by Betsey Copping Corner.

Dr. Robbins came to The New York Botanical Garden in February 1937 from the University of Missouri where he had been Dean of the Graduate School 1930-1937; acting president 1933-34. He joined the University's faculty after serving with the army in World War I and spending a year with the United States Department of Agriculture.

At that time Columbia, Missouri, was distinctly rural—few cars, no buses, and roads almost impassable in winter. The botany department was small, assistants were few, so Dr. Robbins had to teach almost everything, even taxonomy, and he conducted field trips in the back woods around the town. But Dr. Robbins built the department up—getting money for graduate assistants and developing a good teaching staff with esprit de corps. There were four to five hundred students in general botany; a limited number in the upper classes took the course in bacteriology and plant physiology, with Dr. Robbins teaching the latter. Dr. H. W. Rickett joined the department in 1924, and in 1927 suggested they collaborate on a texbook on botany for the general course. They did so — it was a big success and ran through three editions.

Dr. Robbins was born in North Platte, Nebraska, on February 22, 1890, the son of Frederick Woods Robbins, a school teacher, and Clara Federhof. When he was two years old, his father moved the family back to Pennsylvania to become superintendent of schools successively in Towanda, Bethlehem, and Williamsport. Dr. Robbins' interest in plants was aroused at an early age during the summers he spent on his grandmother's farm.

Dr. William J. Robbins

He was graduated from Lehigh University in 1910, and after a year of teaching, joined the faculty of Cornell University with the idea of becoming a scientific farmer. He received his Ph.D. in 1915, and became professor of botany at Alabama Polytechnic Institute in 1916.

Before he accepted the position of Director of The New York Botanical Garden, Dr. Robbins had been invited to be research professor at the University of Wisconsin and president of Lehigh University.

Dr. Robbins was elected a member of the American Association for the Advancement of Science in 1914, elected a Fellow of this Association on December 30, 1920, and served as Vice-President and Chairman of the Section on Botanical Science in 1943. He has been a member of the National Academy of Science since 1940 and its treasurer since 1948; a member of the American Philosophical Society since 1941 and its president since 1956; he was Chairman of the Biological Sciences Fellowship Board of the National Science Foundation 1941-45; and is a trustee of the Rockefeller Institute for Medical Research, a member of the National Research Council, and identified with other scientific organizations, including the Botanical Society of America in which he has always been active and served as its president in 1943.

He has presented papers before distinguished gatherings and has had many papers published in scientific publications. Though now retired from active participation in the affairs of The New York Botanical Garden, Dr. Robbins is maintaining his keen interest in it and is coming to the Garden to observe experiments and watch the progress of studies he initiated in the Research-Laboratory.

Advisory Council. At the annual meeting of the Advisory Council of The New York Botanical Garden, held on December 5, 1957, Mrs. John D. Beals, Jr., was elected

Chairman; Mrs. John E. Parsons and Mrs. John E. Lockwood, First and Second Vice-Chairmen, respectively; Mrs. L. Whittington Gorham, Recording Secretary; Mrs. Edwin C. Jameson, Corresponding Secretary; and Mrs. Richard De W. Brixey, Treasurer.

Sixteen Old English Prints depicting rice manufacture in China have been presented to The New York Botanical Garden for display in the Museum Building by Mrs. Edwin C. Jameson. The originals were brought from China and these prints made in England.

Edgar A. Whitney, who is the instructor of the course in "Flower and Landscape Painting" at The New York Botanical Garden is the subject of an article in the February 1958 number of American Artists. The article is illustrated by two of Mr. Whitney's water colors "Booming Surf," reproduced in black and white and "Mountain Top," reproduced in color. Mr. Whitney's new book, WATER COLOR, will be published by Watson Guptill.

Torrey Botanical Club. The annual meeting and banquet of the Torrey Botanical Club was held at Hunter College on January 21, 1958. Dr. H. W. Rickett, retiring president, officiated. Dr. Lela Barton of Boyce Thompson Institute gave an address on "Gibberellic Acid, Wonder Drug in Plant Growth."

Joseph Monachino, a member of the staff of The New York Botanical Garden, is Chairman of the Field Committee, responsible for the program of field trips which have been a feature of the Club's activities since the days of John Torrey himself.

Dr. Edwin T. Moul of Columbia University was elected President and Dr. James E. Gunckel Jr. of Rutgers University Vice-President.

The Torrey Botanical Club, the oldest botanical society in America, welcomes *amateurs* as well as professional botanists on its field trips which occur on Saturday and Sunday beginning the first of April. Dues for field trip (associate) membership is two dollars a year. If interested contact the Librarian of The New York Botanical Garden.

In Appreciation of the Children's Annual Flower Arranging Competition. Several letters were received from pupils of P.S. 95, Bronx, who participated in the competition at the Garden on October 26, 1957. Here is the letter from Barbara Stein who won an honorable mention for her arrangement:

"I should like to thank you very much for allowing our School, P.S. 95, Bronx, to participate in your Eleventh Annual Flower Arranging Contest. That contest helped to open my eyes to a new world of flowers and flower arranging. You gave an excellent lecture on flower arranging and that along with the excellent guidance of my teacher, Mrs. Jean Lyons, helped me to win an honorable mention.

"Arranging the flowers and leaves was a lot of fun. Though I didn't get the exact flowers and leaves that I wanted, I made the best of them and I was successful.

"I enjoyed the films shown while we were waiting for the results of the contest. They were a lot of fun to watch. I particularly enjoyed the film about the Corning Glass factory. It was very interesting to see how glass is made.

"Thank you again for allowing us to take part in your contest. I don't know about the rest of the children, but all the contestants from my class had a wonderful time."

Desmond Arboretum. New York State Senator and Mrs. Thomas C. Desmond have announced that the arboretum at their home about two miles north of Newburgh, New York, although privately owned and maintained, will be open to the public without charge from now on during the hours from 10 a.m. to 4 p.m. on all weekdays. No advance notice of visits is necessary.

The Desmond Arboretum has an especially lovely location, with a striking view which extends south nearly ten miles to West Point through the Highlands of the Hudson River, and is a result of the joining of two old estates which were carefully and wisely planted about one hundred years ago. The special desire has been to include in the Arboretum specimens of all North American trees, shrubs, and woody vines which might prove hardy in the Newburgh, New York, climate. This objective has nearly been obtained, through cooperation with many of the leading nurseries of the United States and Canada, and through collection of wild plants, particularly in the Rocky Mountain area. The Arboretum now includes about five thousand trees, shrubs, and woody vines of nearly nine hundred different species.

Senator and Mrs. Desmond emphasize that the Arboretum is interesting in winter as well as in the other months of the year. Mr. Desmond is a member of the Board of Managers of The New York Botanical Garden.

In 1950 the Desmond Arboretum was awarded the silver medal of the Federated Garden Clubs of New York State and also, in the same year, the large gold medal of the Massachusetts Horticultural Society.

Dr. James G. Horsfall, Director of the Connecticut Agricultural Experiment Station and internationally known plant pathologist, has been appointed to a four-year term on the Advisory Committee for Biology and Medicine of the Atomic Energy Commission.

Ninth International Botanical Congress will be held in Montreal, Canada, August 19-29, 1959, with the University of Montreal and McGill University sharing the honors of entertaining the Congress. Dr. W. P. Thompson, President of the University of Saskatchewan, and an international authority on the genetics of cereals, especially wheat, has been named President of the Congress.

American Dahlia Society Inc., held its annual meeting in New York City on the afternoon of January 18, 1958. Dr. Bruce B. Preas was re-elected President, Edward B. Lloyd Secretary, and Henry Olsen Treasurer. The Chairman of the Trial Grounds Committee reported two hundred and twenty-two entries in the Society's five trial gardens during the past year, and announced that 1957 Derrill Hart Memorial Awards have been given to variety 'Vera Seyfang,' in the "A" size, to 'Iva Jean' in the "B" size, and to 'Mauney C' in the "BB" size. Gold Medals of the American Dahlia Society were awarded to Charles M. Diffendorffer for the splendid work he has done as Chairman of the Joint Classification Committee and to President Preas for his loyal and unselfish service to the American Dahlia Society.

The 1958 exhibition will be held on the observation deck of the Newark Airport Passenger Terminal, on invitation from the Port of New York Authority, on September 13 and 14.

Prize-winning contestants

President Preas announced that The New York Botanical Garden had had an outstanding display of dahlias last fall and requested all to cooperate with the Garden in its continuance. A guest at the annual meeting, Mrs. Dorothy Ebel Hansell, Editor of The Garden Journal, spoke at the annual banquet the same evening about the dahlia crescent at the Garden and the fine cooperation from officers and members of the Society which helped to make the dahlia display possible. Mrs. Hansell also mentioned the cooperation of the American Iris Society and the American Peony Society in re-establishing the iris and peony collections, and the cooperation of other friends of the Garden in building up the daylily and other perennial plant collections. Such cooperation is appreciated.

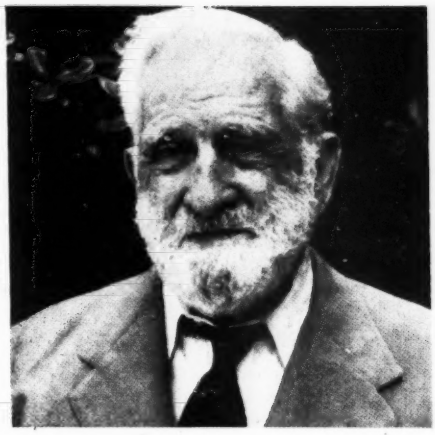
American Home Achievement Medals 1957 were awarded to the following varieties: four medals to 'Goody;' three each to 'Helen Hayes' and 'Renee;' two each to 'Lawrence Welk,' 'Iva Jean,' 'Sophie R,' 'Revival;' and one each to 'Clariam Royalty,' 'Clariam Idol,' 'Caldwell's Show Window,' 'Mid-America,' 'Harriman's Folly,' 'Barbara Holke,' 'Chameleon,' 'Terrific,' 'Donnette Robin,' 'Mauney C,' 'Pamela Kay,' and 'Vera Seyfang.' The latter is from Australia and was exhibited at a show by the Rocky River Dahlia Gardens.

The Third Annual Connecticut Daffodil Show of the American Daffodil Society will be held on April 29 and 30, 1958, at the YMCA, Greenwich, Conn. Ten garden clubs of Greenwich and environs are jointly sponsoring the show and offering classes in accord with the division and subdivision list of the Royal Horticultural Society. Entry registration from novice, amateur and professional gardeners throughout Connecticut and nearby areas should be sent to Mrs. Roland Colby, 10 Brookside Drive, Greenwich.

The New York Unit of The Herb Society of America will present an all-day symposium on Herbs — Their Cultivation, Use, and Legend on April 17 at The New York Genealogical Society, 122 East 58th St., New York City. Morning session, 10:30 to 12:30; afternoon session, 2 to 4 p.m. Nationally known authorities will lead the discussions. The program is open to the public, without charge, as the Unit's contribution to the gardeners of the metropolitan area.

The Genus Pinus by George Russell Shaw, published by the Arnold Arboretum in 1914, has long been out of print. There have been requests for a photo-offset reprint of this work which the Arboretum is considering if it is assured of advance orders for fifty copies. Price $15 per copy; advance orders till March 1, 1958, at $12 per copy, from The Librarian, Arnold Arboretum, Jamaica Plain 30, Mass.

Joseph J. Lane of House and Garden was presented the coveted Tessie K. Scharps Memorial Life Membership Award by the Horticultural Society of New York at its 58th annual meeting. Mr. Lane is the fifth person to receive this award which is presented to the one who, in the opinion of the Society's entire membership, has served horticulture in a unique manner. Dr. George H. M. Lawrence, Director of Bailey Hortorium, received this honor in 1957.



William Alphonso Murrill
1869-1957

One of the distinguished figures of the Garden's history, a notable contributor to the science of mycology, a born naturalist and teacher, and one of the most admired and most derided botanists of his generation, Dr. W. A. Murrill died at Gainesville, Florida, on Christmas Day of the past year. A life of hard work, brilliant accomplishment, and complete obscurity ended among friends in a climate of respect and encouragement for his labors in his chosen science.

Dr. Murrill was born October 13, 1869, near Lynchburg, Virginia, where his parents had opened a school for girls. A succession of changes carried the family still farther west into the Virginia mountains, and the scientist was later to comment often on his country upbringing and its contribution to the life of, in his own characterization, the Naturalist. The Murrills were far from prosperous, but their sacrifices and the diligence and ability of the children provided education for four sons and three daughters; William took his B.S. degree from Virginia Polytech at the age of seventeen and, after a spell of teaching, his M.A. from Randolph-Macon (Ashland) at twenty-one. After eight years of teaching in Virginia private schools, he was able to go on for university work; given the choice between zoology at Hopkins and botany at Cornell, he elected botany. He received his doctorate in 1900 for work with Atkinson on a cytological problem; his last year at Cornell he also taught plant pathology.

The next four years he taught at DeWitt Clinton High School in New York City, lived near Columbia, attended St. John the Divine, met with the Torrey Club, and rode the elevated to work. He noted later that locomotion in the city was like plowing a field of stumps, but found much there to enjoy. During the academic year Professor Underwood opened to him his cryptogamic library and herbarium at Columbia. Two of these summers he spent in Europe, at the Geneva Botanical Congress and in herbaria. In 1904 he came to the Garden as Curator of Fungi.

At the Garden Dr. Murrill began the long series of publications that have justly earned him a place of honor in American mycology. The greatest number dealt with Hymenomycetes, especially the fleshy species (mushrooms) and the wood-destroying pore fungi. He found a prevailing tradition of classification into a few unrelated and arbitrary genera and left a system of natural, well-defined and scientifically defensible ones. He found a nomenclature based on a variable and contradictory tradition and introduced one determined by exact history, clearly stated law, and logic. But the replacement of seven generic names (however meaningless) by seventy (however sound) earned him the title of splitter; and the precise nomenclature was that of the American Code, which was obligatory at the Garden, but which, because it brought about many nomenclatural changes, was detested by those from whom anything once learned immediately became universal usage. The excellence of the Murrill classification was nearly lost in the accumulation of denunciation showered on the Murrill nomenclature, and only in recent years has mycology caught up with and, to a considerable degree, adopted the Murrill polypore taxonomy. It must also be noted that at the same time he was exhibiting notable perspicacity in the delimitation of genera, Dr. Murrill was suffering from as poor an eye for specific similarities and differences as ever afflicted an American mycologist, and that compared to his work with polypores his attempt to reclassify boletes was of no value. Besides his studies in the Hymenomycetes he published innumerable other mycological works, from six-line notes on the edibility of mushrooms to the pioneer and fundamental investigation of the calamitous chestnut-blight fungus.

Dr. Murrill almost annually made extended journeys for collecting and study—across the whole United States, as far south as Buenos Aires, many times to the Caribbean and to western Europe. In the course of these travels he accumulated the most valuable part of the Hymenomycetes now in the Garden's collections. In 1906 he was made assistant director, an office of considerable responsibility at any time and, because of Dr. Britton's frequent absences in the tropics, often a double burden. Of his many accomplishments three deserve special mention. The first was the founding and, for sixteen years, the editing of *Mycologia,* now as then the chief organ of publication of American mycological work. The second was the adding, during one of the director's absences, of some two hundred fifty acres to the area of the Garden. The third, also accomplished during the director's absence, with the cooperation of the Board of Managers, was a general increase in salaries and wages for the staff —a step of which he was very proud, but that received little sympathy from Dr. Britton. At various times Dr. Murrill served also as curator of public instruction, pathologist, and editor of the *Journal.*

In August, 1924, he left the Garden. His informal autobiography gives no reason other than that the accumulation of administrative duties left him little time for research, and no more plausible explanation seems to have been announced. At about the same time he suffered a family loss perhaps even more stunning than the professional one. From whatever circumstances, at the age of fifty-four Dr. Murrill's public life ended. He retired to the home of an aunt in Virginia, and then dropped completely out of sight. There were rumors of his having been seen working as a manual laborer in Richmond; but those who benefited from his scientific labors —studying the collections he had accumulated, or using the books he had written—could learn nothing of his whereabouts, or whether he was alive or dead. But later, sometime in the '30s, he turned up in Gainesville, nearly penniless. Good friends at the University of Florida helped him to settle down there; he built a little house,

planted a garden, and returned to all of the studies appropriate to a naturalist. He had a place to work in the mycological herbarium, and there wrote a number of papers on Florida fungi, and a few on other phases of botany. He engaged in researches on the development of pharmaceutical products from fungi, but gave up that study because he did not approve the use to be made of some of them. He seems to have been a familiar and admired figure on the Florida campus. At the Gainesville biology meetings, in 1954, he attended the mycological foray and helped his northern colleagues to a knowledge of Florida fungi. He died knowing of the increasing recognition of the value of his work.

DONALD P. ROGERS,
Dept. of Botany, University of Illinois

BOOK REVIEWS **(from page 72)**

zation and flux, two seemingly contradictory states, are considered. He first considers the replacement of cells in the body and consequently the production of new cells by cell division. Stepping down to the molecular and atomic level, he presents the concept that, in spite of its intricate organization, the living cell continually exchanges its atoms and molecules with those in the environment.

Under the heading of variations and mistakes he considers the changes that occur when cells grow and divide—many of these changes are called mutations (hereditary changes passed on to the cells' descendents). In a long chapter he discusses cancer from the cellular point of view, its nature, production and treatment.

Leading off with the statement, "Life destroys life," the role of death in the economy of living things is explored. The importance of death is that it allows the materials trapped in the bodies of plants and animals to be used over and over again in the renewal of life—the unending cycle that allows diversity and changes. Even the cells of the body have a predictable life span. Serious deviations from the schedule have serious effects on the body as a whole and may result in its destruction. In considering the loss and replacement of cells, he is led to the consideration of templates, patterns from which new cells or cell parts are fashioned, not only in one individual's body but from generation to generation. The most likely candidate for this persisting pattern is deoxyribonucleic acid which resides in the chromosomes of the cell nucleus. These large complex molecules are thought to carry information in a coded form for the kinds of protein molecules the cell requires for its function and growth.

J. HERBERT TAYLOR
Dept. of Botany
Columbia University

MARINE ALGAE OF THE NORTHEASTERN COAST OF NORTH AMERICA. William Randolph Taylor. 509 pages, illustrated by Chin-Chih Jao; indexed. University of Michigan Press, Ann Arbor. Revised edition 1957. $12.50

Those who have been awaiting the revised edition of this dependable reference book will be pleased with the new volume. Including changes in nomenclature and classification which have resulted from critical studies by various workers during the past twenty years, it has retained all the good features of the first edition. We may still depend upon it for advice about the collection and preservation of algae, for reliable keys, descriptions and illustrations, and for information about characteristic habitats and distribution within the area treated. The section on algal habitats has been enlarged to include the results of studies of arctic forms.

In the systematic list, a number of changes are noted, a few in the treatment of orders and families, more in generic and specific names, the latter affecting some of our best known marine algae. For example, five former species of *Ectocarpus* have been placed in the genus *Giffordia*, two others in *Streblonema*. The name *Mesogloia* has been replaced by *Sphaerotrichia*, *Aegira* by *Eudesme*, *Phyllaria* by *Sacchorhiza*.

Sargassum is separated from other Fucales in the family Sargassaceae.

Among red algae there are some noteworthy changes in specific names. Among others, *Gracilaria confervoides* is now *Gracilaria verrucosa*; *Polysiphonia variegata* is changed to *P. denudata*, *Rhodomela subfusca* to *R. confervoides*.

Despite the changes, the book is familiar in plan and arrangement and is no larger than before. The sixty plates of excellent illustrations, chiefly by Chin-Chih Jao, are only slightly changed. There are important additions to the bibliography which, as the author states, "was selected to give substantially all catalogs and lists of algae of the area covered and scattered reports of algae of the district in American journals."

JENNIE L. S. SIMPSON
Dept. of Biological Sciences
Hunter College

AUSTRALIAN TREE PORTRAITS. Charles P. Mountford. 69 pages, illustrated (drawings by Gwen Walsh). Cambridge University Press, New York. 1956. (Printed in Australia.) $8.50

Just imagine a book about trees created, of all things, by a distinguished ethnologist who loves beauty in nature and whose hobby is photography! He almost makes you believe that the plant monarchs he portrays are Australia's most important or most significant species. He is helped by the lilting common names as he writes of the coolibah that grow by the billabong, of the myall and the mallee, till you think of Edward Lear.

And then you realize that the author is merely writing poetry with a lens and you appreciate the forty gorgeous full-page portraits, each fine enough to frame for your den, and his incidental descriptions of these strange and lovely trees fade to just part of the chorus. The pictures are lifted into the field of art by exquisite printing (The Griffin Press, Adelaide) in many tones of black and brown and green, with marginal drawings by Gwen Walsh of flower, fruit and leaf. You don't have to like trees to love this book.

EDWIN A. MENNINGER
Stuart, Florida

CITRUS FRUITS (Revised edition of The Cultivation of Citrus Fruits.) H. Harold Hume. 444 pages, illustrated, indexed. Macmillan, New York. 1957. $10.50

This book can serve as a practical guide for citrus growers, a textbook for students of citrus culture, or as a source of information for the botanist interested in subtropical and tropical plants Rutaceae.

A wide variety of information, some old, some new, is included. Dr. Hume has followed the citrus industry from its earliest days to its present important place in the agriculture of the world. In both experimental and practical aspects of citrus culture, he has been one of the most outstanding figures in the United States.

The author has been able to select pertinent information on the classification of citrus from others, add to this his own extensive knowledge, and provide a lucid picture of the interrelationships of the genera and species. This is a more difficult task than one would think, as much so because of the confusion from many attempts to group the species and horticultural varieties as the peculiarities of the plants themselves. Several species are not known in the wild. The origin of these species has not been determined, and whether they represent mere offshoots of other species by mutation or hybridization has to be decided.

Originally from southeastern Asia, where Chinese knew and studied the various kinds hundreds of years B.C., the citrus fruits have been carried all over the world. Plants brought to the New World by Spanish explorers escaped and became naturalized to such an extent that they appear to be native elements of the flora. Some of these (sour orange, rough lemon), of little value for their fruits, provide the best stock available for grafting the more desirable fruits.

The three most important genera, *Poncirus*, *Fortunella*, and *Citrus*, with the species and varieties, are adequately described in the first eleven chapters.

Most emphasis is placed on growing conditions in Florida, but other citrus areas and problems of the United States are discussed. The information on fertilizer treatments, insect and fungus disease control,

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One paragraph is devoted to the marketing of citrus products through processing plants, either as canned, concentrated or as pasteurized products. In view of the contribution of the frozen concentrate industry to the increased utilization of citrus, it seems too bad not to mention the factors connected with marketing of fruits for these products.

There is a chapter devoted to the use of citrus species as ornamentals, either outdoors in warm climates or as potted plants in homes and greenhouses of colder zones. Anyone familiar with the fragrant flowers and bright fruits of a calamondin will agree that the group has not received enough attention for these purposes. Full directions for potting, soil mixtures, pruning, etc., are given.

DAVID J. ROGERS

VEGETABLE CROPS. Homer C. Thompson and William C. Kelly. 611 pages, illustrated, indexed. McGraw-Hill Book Co., New York. Fifth edition 1957. $8.50

The fifth edition of VEGETABLE CROPS with the joint authorship has been well revised in both the research and production material and is the best of recent publications in the field of vegetable production. The book is designed as a college textbook, but will prove to be a valuable reference for all agricultural teachers, extension workers, seedsmen, salesmen of agricultural supplies, and commercial vegetable growers and other farmers.

The authors begin by showing the importance of the vegetable industry in the United States, the types of vegetable production and the importance and value of vegetables from the standpoint of eating habits and nutritive value. Then five chapters are devoted to the scientific and practical aspects of soils, their improvement and management, and give essential information regarding vegetable seeds, their production, storage and life expectancy under varied conditions.

The next five chapters are concerned with the planting of vegetable crops in the open, along with the latest information relating to the materials and practices to be used for the control of insects and diseases.

The remaining fourteen chapters are concerned with scientific and practical aspects of the culture of seventy-five different vegetable crops. The principles involved in the harvesting, packaging, marketing and storage of these crops are presented in a manner that is easy to read and understand.

LYMAN G. SCHERMERHORN
N. J. Agr. Exp. Station
New Brunswick, N. J.

ADVANCES IN PEST CONTROL RESEARCH. Volume I. Edited by R. L. Metcalf. 514 pages, indexed. Interscience Publishers, New York. 1957. $11

Fourteen of the world's best scientists have contributed ten excellent treatises in the broad field of pest control. Included are such subjects as the control of health hazards associated with pesticides, the chemistry and mode of action of herbicides, uses of radioisotopes in pesticide research, and mechanisms of fungitoxicity. This is a highly specialized book for use by teachers and research workers in the ever broadening field of pest control.

P. P. PIRONE

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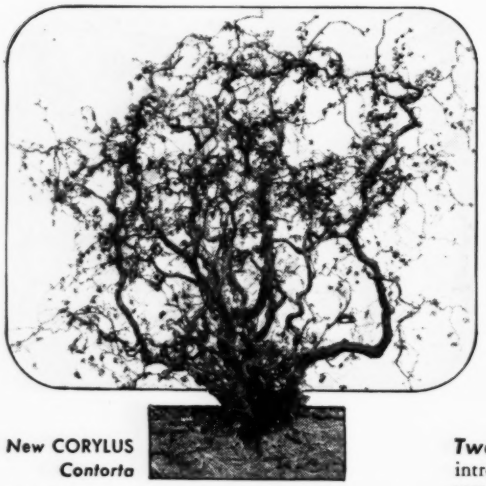

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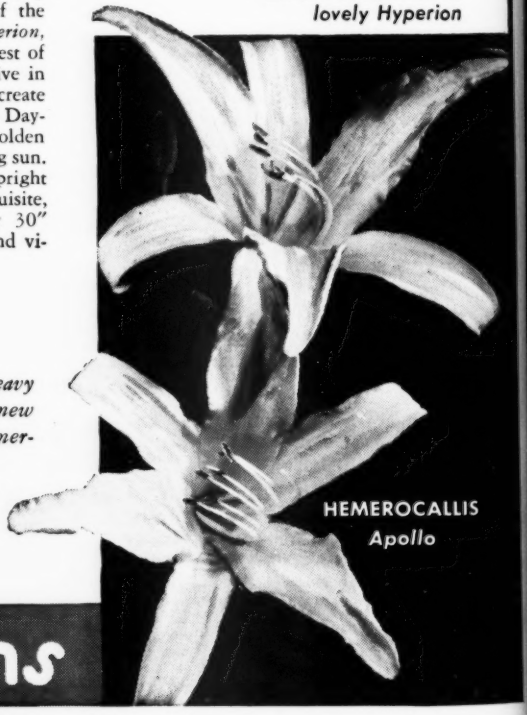

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